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ABSTRACT

This guide, which is one in the "Exploration" series of curriculum guides intended to assist junior high and middle school industrial educators in helping their students explore diverse industrial situations and technologies used in industry, deals with exploring computer technology. The following topics are covered in the individual lessons: the parts of an information processing system (people, data, procedures--software, and computer technology--hardware); computer hardware (input, processing, storage, and output devices); computer software (elements in a computer system, types of computer languages, various computer languages and their applications, and procedures for entering a program); program planning; procedures for writing a program in BASIC; computer-aided design/drafting; computer-aided manufacturing; robotics; electronic publishing; and management information systems. The guide includes the rationale behind its development, hints to the teacher, lesson plans, student handout masters, teacher aids, a unit examination, and a list of references. The lesson plans include cross-referenced lists of objectives, lesson content, and learning activities. (MN)

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The Illinois
Plan for Industrial
Education

Illinois
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Education

Adult,
Vocational and
Technical Education

ED296093

EXPLORING COMPUTER TECHNOLOGY

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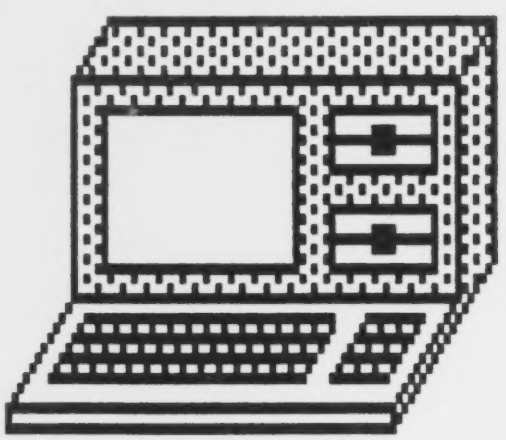

PACKET INCLUDES:

- Rationale
- Hints to the Teacher
- Lesson Plans
- Student Handout Masters
- Teacher Aides
- Unit Examination
- References

ILLINOIS PLAN FOR INDUSTRIAL EDUCATION

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INTRODUCTION

"Exploring Computer Technology" is one of a series of curriculum materials developed for junior high and middle school industrial educators. Listed below are the titles of the units in the series.

Communication
Using the Language of Industry
Exploring Computer Technology
Exploring Photography
Exploring Graphic Communication
Exploring Electronic Communication

Energy Utilization
Exploring Solar Energy
Using Alternate Energy Sources
Conserving Energy Sources
Exploring Electricity/Electronics
Exploring Mechanical and Fluid Systems

Impact of Industry and Technology
Recycling Materials
Limiting Pollution
Exploring Careers in Industry and Technology
Exploring Technology and the Future

Production
Exploring Materials and Processes
Exploring Construction Technology
Research and Development
Exploring Manufactured Systems
Servicing Products

Transportation
Exploring Land Transportation Systems
Exploring Aviation Technology
Exploring Water Transportation Systems
Exploring Space Transportation Systems
Exploring Materials Handling Systems

With the Exploration Series, industrial educators can lead their 7th and 8th grade students in exploring many industrial situations and technologies used in industry. In addition, this series can serve as a resource for teachers orienting 9th and 10th grade students to industrial technologies in communication, production, energy utilization and transportation. Each unit in the series includes a rationale, hints to the teacher, lesson plans, student handouts, teacher aids, a unit examination, and a list of references.

"Exploring Computer Technology" and other units in the series are available on a cost recovery basis through the Curriculum Publications Clearinghouse, Western Illinois University, Horrabin Hall 46, Macomb, IL 61455.

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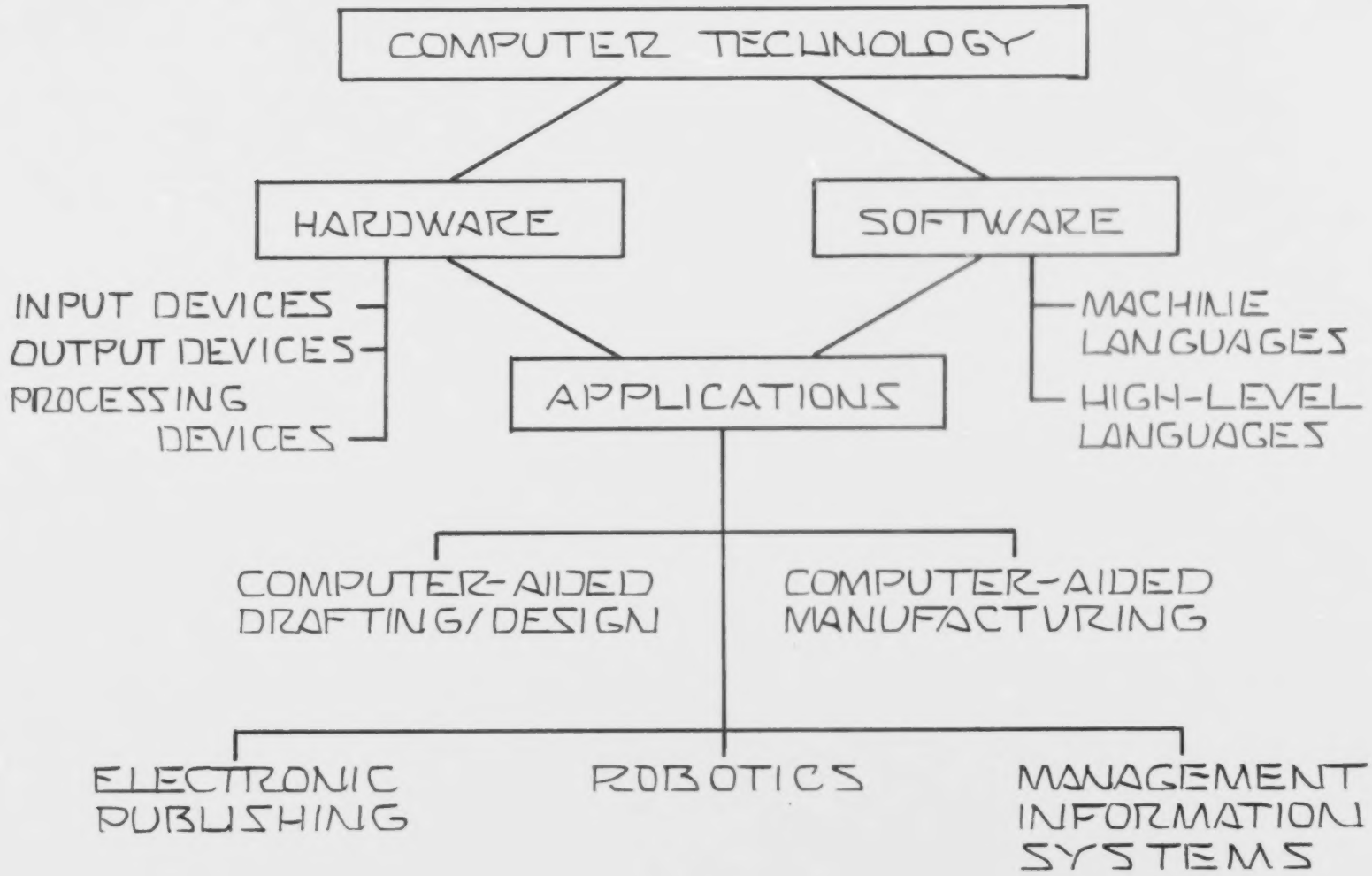
RATIONALE

The computer has become a vital tool in contemporary industrial practices. Computer Technology is used in many phases of the technologies of production, communication, energy utilization, and transportation. Manufacturing and construction firms use computers to design products, control machines, and manage information. In communication technology, computers compose newspapers, create business graphics, and switch telephones. Space, air, water, and rail transportation systems use computers in their guidance and navigation systems. Computers are used to locate fossil fuel deposits, to monitor and control energy conversion processes, and to conserve energy.

Students need to recognize the advantages and roles of computer technology in today's industry and technology. Innovations in communications and information technology make the computer a basic tool for acquiring knowledge, organizing systems, and solving problems. Students need to understand what computers can and cannot do, how they are changing the work place, and what problems and issues have evolved from their use.


COMPUTER TECHNOLOGY
HARDWARE
SOFTWARE
INPUT DEVICES
OUTPUT DEVICES
PROCESSING DEVICES
APPLICATIONS
MACHINE LANGUAGES
HIGH-LEVEL LANGUAGES
COMPUTER-AIDED DRAFTING/DESIGN
COMPUTER-AIDED MANUFACTURING
ELECTRONIC PUBLISHING
ROBOTICS
MANAGEMENT INFORMATION SYSTEMS

HINTS TO THE TEACHER

1. Investigate the kinds of computer hardware and software available in your school. If you have access to computer resources, determine if any are applicable to your industrial technology class. Access to a computer lab with at least one computer for every two students would be ideal for implementing this curriculum. If, however, you have access to only a few computers, you may want to create several work stations for activities included in these materials. Students could then rotate through the work stations and address each activity at their own pace while the rest of the class studies other units.

2. Evaluate the software available to you and determine what additional software is needed. The software required for most of these activities costs about $50.00. But remember, the software we list are only suggestions. Keep informed of new developments in the field.

3. One important consideration when purchasing software for this unit is the amount of time it will take your students to learn. Purchasing software on approval allows you to review the software and return it if it is too complicated. If a piece of software cannot be purchased on approval, check with the Illinois Vocational Curriculum Center (in-state, call 800/252-4822; out-of-state, call 217/786-6375) to see whether they have it available for review.

4. It is important that your students learn that computers have many different applications in industry. To teach this, have students doing as many different activities as possible. If time is limited, emphasize use of the computer for industrial applications (CAD, CAM, MIS, robotics, and electronic publishing).

5. If your own experience with computers is limited, you may be able to identify students in your classes who are very knowledgeable, and may serve as consultants for other students.

6. You will need to provide one diskette per student or team of students. These disks can be used over and over again. We recommend that the disks never leave the classroom. Give students their disks at the start of class and ask them to return them to you at the end of class. This practice should minimize disk damage, copying of assignments, and losing projects.

7. Become thoroughly acquainted with the computer yourself. If you need to learn as you teach, this unit will take too much time and you may become frustrated.

8. Even if you have enough computers, have students work in teams. Teachers report working in teams helps students solve many of their own problems. This idea fits with work in the real world, where few people really work alone.

9. Keep programming in perspective. It is easy to emphasize computer programming too much. Fewer than ten percent of those who use computers need to know programming. But experiencing the programming process does develop problem-solving skills. It helps you to think logically, and gives you a better understanding of how the computer works and an appreciation for software. In addition, experiencing programming helps students realize that the power of computers lies with people.

10. You may want to make students' favorite programs available for their use when they finish assignments early or achieve given objectives.

11. The programs included in these materials were written for the Apple II (Registered Trademark) series of computers. They can easily be revised for other brands of computers. All of the software packages mentioned are available for Apple (Registered Trademark) computers. Many of these packages are also available for other brands of computers. Check with the software publishers.

12. It is difficult, if not impossible, to provide every student with a workstation for each computer application studied. Your primary goal during an exploration unit of this kind is to allow students to experience the information processing potential of a computer in an industrial context. Therefore, you may want to establish one or two workstations for items like CAD, CAM, robotics, MIS, and electronic publishing. Rotate students through as many workstations as possible. Each student may only be able to experience one or two of the computer applications.

UNIT: Exploring Computer Technology

LESSON 1: Introduction to Information Processing

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify the element required to process information using computer technology.	A. Part of an Information Processing system 1. People a. need the information b. design the system c. design and write programs d. operate the equipment e. gather the data f. monitor the quality of work 2. Data (information) a. sales b. personnel c. inventory d. quality control e. etc. 3. Procedures (software) a. job instructions (for people) b. programs (for hardware) 4. Computer Technology (hardware) a. input b. storage c. processing d. output	A. Teacher-Guided Discussion 1. Discuss the roles that people have in processing information efficiently. 2. Discuss and provide examples of data. 3. Discuss the two types of procedures. 4. Explain the role of hardware in processing information.	TA #1-1: Introduction to Information Processing

NOTE: TA - Teacher Aid
HO - Hand Out
OT - Overhead Transparency

B. During a lab activity, given a list of numbers, a list of steps, and a calculator, students will be able to process information resulting in a correct answer.	B. Processing Information 1. reading data 2. following procedures 3. using hardware 4. processing data	B. Learning Activity 1. Divide the class into groups of three. 2. Provide one member of the group with a list of numbers (HO #1-2), one member with a list of steps (HO #1-3), and one member with a calculator. 3. Provide the students with a defined period of time for solving the problem. 4. After this period, ask how many students solved the problem correctly. 5. Ask the students if they could answer the problem in the time allowed without people, the data, the steps, or calculator. 6. Using the program provided in TA #1-1, demonstrate how the same problem could be solved more efficiently using a computer.	HO #1-1: Introduction to Information Processing HO #1-2: Introduction to Information Processing -- Learning Activity HO #1-3: Intro. to Information Processing OT #1-1: Information Processing Problem: "Solve for I"

INTRODUCTION TO INFORMATION PROCESSING

Preparation:

For this activity, you will need several calculators. Before you implement this activity, borrow calculators or have several students bring calculators to school. In addition, you may want to demonstrate how the problem provided can be solved with a computer. You will need to type in the program at the end of the teacher aid and obtain one computer for your demonstration.

Introduction:

Using OT #1-1, list the four basic elements required to process information. Discuss the roles people have in efficiently processing information. Provide examples of people who use information, design information processing systems, design and write information processing programs, operate information processing equipment, gather data, and manage information processing activities.

Define the concept of data (information). Provide examples of information that requires processing. Have your students list examples and write them on the chalk board. Use examples like their own electricity consumption, an athlete's statistics, and census data.

Explain the need for procedures when processing information. Discuss the two types of procedures. Explain how job instructions are for people and programs are for information processing equipment (computers).

Discuss the role of hardware when processing information. Use a calculator as an example. Explain how information is entered (input), is processed, and is displayed (output).

Learning Activity:

Using OT #2-1, display a problem that you need to solve. The mathematical problem that involves data (a list of numbers), procedures (a sequential series of steps), and computer technology (a calculator). Divide the class into groups of three. Provide one member of each group with a list of numbers (HO #1-2), one member with a list of steps (HO #1-3), and one member with a calculator. On the chalk board, write the problem for the groups to solve. Provide a defined period of time for these students to solve the

problem. After this period, provide students with the answer to the problem. Ask how many students solved the problem correctly. Ask the students if they think they could answer the problem in the time allowed without people, the data, the steps, or the calculator. Ask students what would have made the information processing more efficient. Hopefully, they will identify more than one person involved in the problem solving process as inefficient. Discuss how their experiences compare to an information processing system. Demonstrate how the same problem can be solved using a computer. List the program so students can see the instructions. Run the program and enter the data. Have students watch how long it takes the computer to solve the problem. Ask students to compare how long it took them to solve the problem and how long it took the computer. Discuss the role people had in solving the problem. Your examples should include persons who gathered the data, wrote the program, built the computer, entered the data, and those who will use it to process information (find the answer).

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]LIST

 10  REM  INFORMATION PROCESSING
 20  REM  INTRODUCTION PROGRAM
 30  HOME
 35  REM  ENTERING PROBLEM DATA
 40  VTAB 5: HTAB 5
 50  PRINT "WHAT IS THE VALUE OF:"
 60  VTAB 8: HTAB 8
 70  PRINT "R1"
 80  VTAB 8: HTAB 12
 90  INPUT R1
 100  VTAB 10: HTAB 8
 110  PRINT "R2"
 120  VTAB 10: HTAB 12
 130  INPUT R2
 140  VTAB 12: HTAB 8
 150  PRINT "R3"
 160  VTAB 12: HTAB 12
 170  INPUT R3
 180  VTAB 14: HTAB 8
 190  PRINT "R4"
 200  VTAB 14: HTAB 12
 210  INPUT R4
 220  VTAB 16: HTAB 8
 230  PRINT "R5"
 240  VTAB 16: HTAB 12
 250  INPUT R5
 260  FOR X = 1 TO 1000: NEXT X
 270  HOME
 280  VTAB 5: HTAB 5
 290  PRINT "WHAT IS THE VALUE OF E?
 295  VTAB 10: HTAB 15
 300  INPUT E
 305  REM  SOLVING THE PROBLEM
310 A = R3 + R4 + R5
320 B = ((A * R2) / (A + R2))
330 C = B + R1
340 I = E / C
 345  REM  DISPLAYING THE ANSWER
 346  REM  TO THE PROBLEM
 350  HOME
 360  VTAB 5: HTAB 5
 370  PRINT "THE VALUE OF I IS    AMPS."
 380  VTAB 5: HTAB 23
 390  PRINT I
 400  VTAB 20: HTAB 5
 410  PRINT "HOW WAS THAT FOR FAST INFORMATION"
 420  PRINT "                    PROCESSING"
 500  REM  RETURN TO INDEX SECTION
 510  FOR X = 1 TO 1000: NEXT X
 520  VTAB 23: PRINT "PRESS RETURN TO CONTINUE..": INPUT Z$
 530  HOME : VTAB 8: PRINT "LOADING THE INDEX"
 540  PRINT  CHR$ (4);"RUN INDEX"
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INTRODUCTION TO INFORMATION PROCESSING

Introduction:

Solving problems often means you have to process information. The four basic elements needed to process information are data, procedures, computer technology, and people.

For example, estimating how much will it cost to build a house is a problem that requires information processing. A lot of information has to be processed to know the cost of building a house. If information is processed correctly, you will know how much money needs to be borrowed to build the house.

In order to estimate the cost, you will need data. Data is basically the information needed to solve the problem. You need to know what kinds of materials are needed, how much of each material you will need, and how much each type of material will cost.

Next, you will need to know how to process the information. The steps you need to follow to estimate the cost of the house are called procedures. There are two basic types of procedures. The first type, called job instructions, is for people. They tell the builder how to process the information. The second type, called programs, is instructions for computers. Programs are written in a language the computer can read and understand.

Unless you want to figure the cost of the house by hand, you will need some form of computer technology. Computer technology can make information processing faster and easier. Computer technology is involved in something as small as a hand-held calculator or as big as a computer which needs its own room.

Lastly, you need other people to help process the information. A variety of people are involved in estimating the cost of building the house. Someone needs to gather information about how big the house will be and what kinds of materials are needed. Computer programmers have to write the program needed to process the information. People from the lumber yard need to provide the cost of each type of material. You will need a computer operator to enter the data into the computer.

INTRODUCTION TO INFORMATION PROCESSING

Learning Activity:

Find the value of "I" (the current flowing through the circuit) by using the data listed below.

R1 = 5 OHMS

R2 = 10 OHMS

R3 = 5 OHMS

R4 = 2.5 OHMS

R5 = 2.5 OHMS

E = 100 VOLTS

I = ? AMPS

INTRODUCTION TO INFORMATION PROCESSING

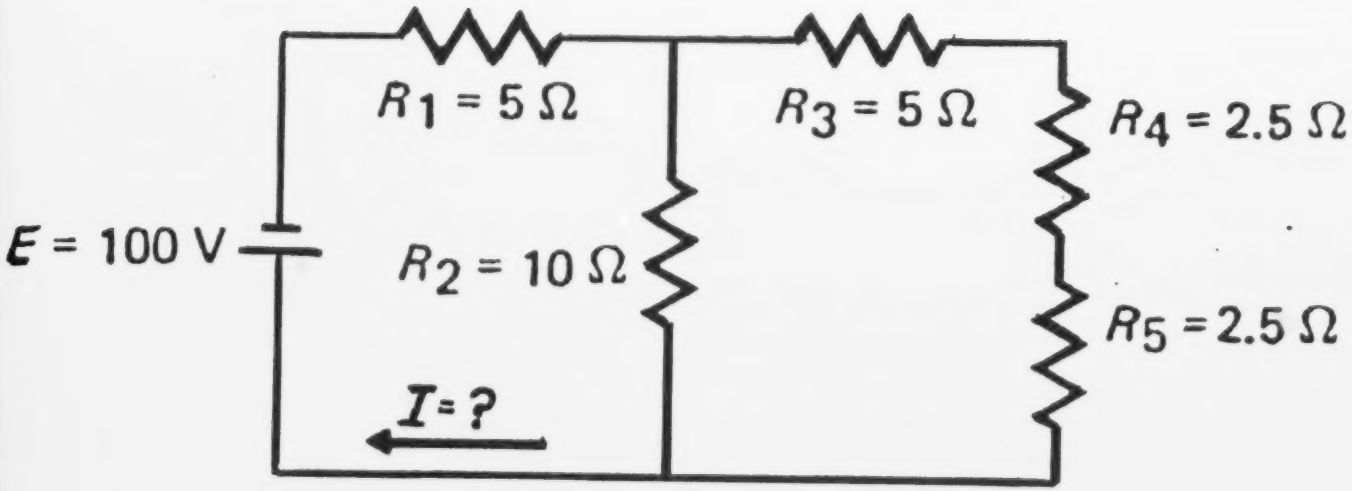
Learning Activity:

Find the value of "I" (the current flowing through the circuit) by using the steps listed below.

1. Add R3, R4, and R5 together and call the answer R345.
2. Multiply R345 times R2 and call the answer R2345M.
3. Add R345 and R2 together and call the answer R2345A.
4. Divide R2345M by R2345A and call the answer R2345T.
5. Add R2345T to R1 and call the answer RT.
6. Divide E by RT and call the answer I.
7. If I is current, how much current is flowing through the circuit?

   I = _____ AMPS

INFORMATION PROCESSING PROBLEM: SOLVE FOR "I"



UNIT: Exploring Computer Technology — LESSON 2: Computer Hardware (2 days)

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -the basic elements that make up a computer system. -the three basic types of computer systems. -the definition for hardware -the basic hardware devices used to input, store, process, and output information.	A. Computer Hardware 1. elements in a computer system a. hardware (the physical devices) b. software (instructions) 2. types of hardware a. microcomputers (small, one user, limited power) b. minicomputers (medium size, multi-user, powerful) c. mainframe computers (large, many users, very powerful) 3. input devices a. keyboard b. graphics tablet c. joy stick d. mouse e. sensor (mechanical, electrical, thermal, optic, and voice activated) f. light pen 4. processing devices a. central processing unit (CPU-microprocessors) b. read only memory (ROM) c. random access memory (RAM)	A. Teacher-Guided Discussion 1. Discuss the basic elements of a computer system. 2. List and describe the three basic types of computer systems, their advantages, disadvantages, and applications. 3. Using OT #2-1, discuss the relationship between input, storage, processing and output devices. 4. Show students a microcomputer. 5. Demonstrate to students how to take care of and boot a diskette. 6. Using one of the popular graphics programs, demonstrate inputting, processing, storing, and outputting information. 7. Explain the purpose of a disk and demonstrate how to initialize one.	TA #2-1: Computer Hardware OT #2-1

5. output devices
   a. monitor
   b. printer
   c. plotter
   d. machine
   e. robot
6. storage devices
   a. mechanically punched cards
   b. magnetic cassette tape
   c. magnetic floppy disk
   d. magnetic tape
   e. magnetic hard disk

B. During a lab activity using computer hardware, students will be able to create a desired product (a poster and/or a hello message) by accurately inputting, processing, storing, and outputting information.

B. Using Computer Hardware
1. Using software and/or using operating commands
2. Inputting information
3. Processing information
4. Storing information
5. Outputting information

B. Learning Activity
1. Using OT #2-1 as a guide, assign each student a part of a computer system.
2. Using one of the popular graphics programs, have students make 8 1/2" by 11" posters illustrating their assigned topic.
3. Using their posters on a bulletin board, have students make a flow chart illustrating the relationship between parts of a computer system.
4. While students are taking turns making and displaying posters, provide students with O #2-1 and have them initialize their own diskette and enter a hello program.

HO #2-1: Computer Hardware

COMPUTER HARDWARE

Preparation:

For the activities included in this lesson you will need to obtain, review, select, and become familiar with a software package to introduce students to the computer and a graphics package for making posters. Listed below are a few of the software packages you may want to consider.

SOFTWARE

Title	Publisher
An Introduction	Apple Computer, Inc.
The Inside Story	Apple Computer, Inc.
Print Shop	Broderbund
Fontrix The Professional	Data Transforms, Inc.
Sign Maker	Sunburst Communications

In addition, you will need to obtain enough computer diskettes so each student will have his own for duration of the unit. A good practice is to have students ask for their disks at the start of an activity and turn them back in at the end of every class. This ensures students are equipped for each activity, the disks are stored properly, and students do not copy assignments from another's disk.

Introduction:

Describe a computer system as a collection of devices (hardware) and instructions (software) that function together to process information. Define hardware as the physical part of the computer system (if you can kick it, it is hardware). Discuss the three basic types of hardware (microcomputers, minicomputers, and mainframe computers), where each type would be used and why.

Using OT #2-1, discuss the relationship between the input devices, the central processing unit, the two types of memory, the storage devices and the output devices. Discuss with students how their eyes and ears are like input devices, their brain is like a central processing unit, and their mouth, arms

and legs are like output devices. Showing a movie, film strip or video tape on the topic of computer hardware and/or integrated circuit technology would be appropriate.

Demonstrate various types of input devices and provide example applications where each would be appropriate. If your school has an Apple computer, use the program entitled "An Introduction" that comes with the computer to show students the function of various parts of the keyboard. In addition, you could use the Apple program, "The Inside Story," to show students the role of RAM, ROM, the microprocessor, and the disk. Individual students could run the program or you could run it for the group on a single computer linked to a large television. If you use a large television, you may want to tape the script first. Listening, versus reading, enables all the students to follow the program at the same pace.

Show students what the inside of a computer looks like by removing the cover on an Apple computer. Point out the microprocessor and the memory chips. Another option is to obtain microprocessors that have been scrapped by a service center or a manufacturer. Carefully open the microprocessor to expose the silicon chip. Allow students to see the circuits on the chip with the aid of a microscope or a magnifying glass.

Explain the purpose of a diskette, how to take care of it, and how to boot into the computer. Explain the purpose of initializing a diskette. Demonstrate how to boot the systems master, how to enter a "Hello" program, and how to initialize a disk.

Use one of the popular graphics software packages (for example, "The Print Shop") to demonstrate the role of the keyboard in entering data, the computer as a processing unit (Print Shop puts "THINKING" on the screen while processing the data), and the role of the printer as an output device.

Learning Activity:

Given access to a computer lab, students can engage in a variety of activities. Depending on time and software availability, students can take turns at each activity. Several students could begin by reviewing a program that introduces them to the keyboard and/or the computer. Another group of students can use one of the graphics programs to make posters for a flow chart. Using OT #2-1 as a guide, assign each student to a part of a computer system. Using one of the popular graphics programs, have students

make 8 1/2" by 11" posters illustrating their assigned topic. Display posters on a bulletin board and have students make a flow chart illustrating the relationship between parts of a computer system.

While students are taking turns making and displaying posters, provide students with a diskette, a systems master disk, and HO #2-1. Have them enter a "Hello" program and initialize their own diskette.

If you have access to only a few computers, you may want to narrow the activity options to one or two. The most important consideration for the hardware activity is that students have an opportunity to input, process, store, and output information using a computer system. Initializing a diskette, as explained in HO #2-1, will fulfill this objective. Future activities will require that each student has a diskette.

COMPUTER HARDWARE

Introduction:

A computer system is a collection of devices (hardware) and procedures (software) that work together to process information. Hardware is the physical part of the computer system. If you can touch it, it is hardware.

There are three basic types of computer systems. The smallest is called a microcomputer. Microcomputers are often called "home" or "personal" computers and are popular tools in schools and small businesses. They are small enough to fit on a table or desk, but can only have one user at a time, and have a limited amount of power. As computer technology advances, however, microcomputers are becoming more powerful. Many of the microcomputers made today are as powerful as the big computers made about 10 years ago.

A medium size computer, called a minicomputer, needs its own small room. More than one person can use a minicomputer at the same time. They are more powerful than a microcomputer becuase they can process more information faster. Minicomputers are often used in medium-sized businesses. For example, a small manufacturing company may keep its inventory, personnel, and sales records in a minicomputer.

Large computer systems, called mainframe computers, often require more than one room for all the hardware, and are very powerful. They can handle more information and process it even faster than a minicomputer. In addition, many people can use the computer at the same time. A mainframe computer can handle the information processing needs of a university, a big hospital, or a large manufacturing company.

No matter how big or small computer systems are, they have the same basic types of hardware. All computers have input devices, processing devices, output devices, and storage devices. A small calculator is a computer. The buttons you push are input devices. The display is an output device. The microprocessor, or chip, inside the calculator is the processing device. Some calculators have a chip inside that can store the information you enter.

Information can be entered into a computer with a variety of devices. Some input devices include the keyboard, a joystick, a mouse, a graphics tablet, and sensors. These devices can be used to enter text (words) or graphics (pictures) into the computer system. When a computer is connected to another system or machine, sensors are used to input information into the computer. Sensors are activated by mechanical movement, electricity, heat, light, or sound.

Once information is entered into the computer, it must have procedures (instructions) to process the data. These procedures are stored in the computer's memory. One type of computer memory is called ROM. ROM stands for "read only memory." Instructions for accepting, managing, and outputting information are stored in ROM. These instructions are put into the computer when it is made so you cannot change them easily.

The second type of memory is called RAM. RAM stands for "random access memory." When information is entered into the computer, it is stored in RAM. Information is actually processed in the "central processing unit" (CPU). In a microcomputer, the CPU is a microprocessor -- a computer chip. Large computers have a CPU which holds many microprocessors. The CPU, ROM, and RAM all work together to process information.

If you turn your computer off, all the information stored in RAM is gone. You need to be able to store programs and information outside of the computer. The first modern computers used mechanically punched cards to store information. Information was stored in the form of holes punched in the cards. When you wanted to enter information, the computer would read the cards. This was a very inefficient way of storing information. Most computers store information magnetically, like music is stored on a cassette tape. Your tape player converts this stored information into music. Computers work basically the same way. Information and programs are stored magnetically on cassette or magnetic tape, or on a floppy or hard disk. You will most likely be working with floppy disks.

After the computer has processed your information, you want to be able to see it. The computer can use a variety of output devices to show the processed information. A monitor, which looks like a television screen, shows the information while you are working on the computer. When you want a typed copy of the information, a printer is used as an output device. If you use the computer to make pictures, a plotter can be the device for drawing the final picture.

Some printers can also be used to print graphics. A computer used to perform a physical task in industry often uses a machine or robot for an output device.

Computer systems come in a variety of sizes and uses a variety of devices to input, process, store, and output information.

How to Care for Your Diskettes:

The programs you write and use are stored on diskettes. If the diskette is damaged, the program will be lost. Here are a few rules to help you take care of your disks.

1. Never place a disk near a magnet.
2. Do not put a disk on top of a monitor, because monitors put out a magnetic field that can erase the disk.
3. Never leave a diskette in direct sunlight.
4. Do not expose a diskette to extreme hot or cold.
5. Always put a disk back into its paper envelope when it is not in the disk drive.
6. Do not store disks inside books or stack books on top of a diskette.
7. Do not let disks get dusty, dirty or wet.
8. Never touch the exposed Mylar part of the diskette.
9. Do not write on a disk label with pen or pencil. Use a felt tip pen or fill out the label before you put it on the disk.

Operation Commands for Apple II, II+, OR IIe (Registered Trademark)

In order to enter your first program, you need to learn a few of the commands used to operate the computer. Here is a list of basic operating commands and what they do.

prompt character	- means your computer is ready for you to input information or commands
RETURN	used to issue a command to the computer - it is also used to end a statement line and begin a new one
LIST	will display on the monitor screen a list of the programs currently in the memory

RUN	run the program currently in the memory
NEW	clears the memory so a new program can be entered
LOAD	loads (moves) a program into the memory from the disk
SAVE	saves (stores) the program currently in memory on to a disk
CATALOG	shows you a list of the programs stored on the disk (table of contents for the disk)
	moves the input cursor (the winking checkered box) to the right
	moves the input cursor to the left

Initializing a Disk:

Disks are made to be used in any computer system. Each disk in a new box is blank. Before you can use your new disk in the computer, you must install a program called the "disk operating system" (DOS). DOS tells the computer how to use the disk. Intalling DOS onto a new blank disk is called "initializing" the disk.

In addition to initializing, you need to create storage places on the disk. These storage places are like houses on a block. Each house has a yard and an address. The information you will want to store on the disk needs an address and a storage place. Initializing a disk also creates addresses and storage places.

How to Initialize a Diskette:

Listed below are the steps required to initialize a diskette. Read them carefully and follow them one by one.

1. Get a DOS 3.3 Systems Master disk and a blank disk from your teacher.

2. With the computer off, open the door on the disk drive and put in the Systems Master with the label facing up. Close the disk drive door.

3. Turn the computer on. The disk light should come on.

4. When the disk light goes off, you should see information on the screen. You need to enter what is called a "Hello" program. This program will display basic information about the disk when it is used in the future. Type the program below exactly as you see it.

Where specific information is requested in small letters, type what applies to you.

Push the RETURN key after every line.

```
10 REM HELLO PROGRAM
20 HOME
30 PRINT "type in your name"
40 PRINT "INDUSTRIAL TECHNOLOGY CLASS"
50 PRINT "type in your class period"
60 PRINT "type in the data"
```

5. When you are sure everything is typed correctly, open disk drive door and remove the Systems Master disk. Put the Systems Master disk back into its paper envelope. Put your blank disk in the disk drive and close the door.

6. Type in INIT on the screen and press the return key. The disk drive light should come on and the disk drive will make a whirring sound.

7. When the disk drive stops and the light goes off, your hello message should be displayed in the upper left part of the screen. See the example list below.

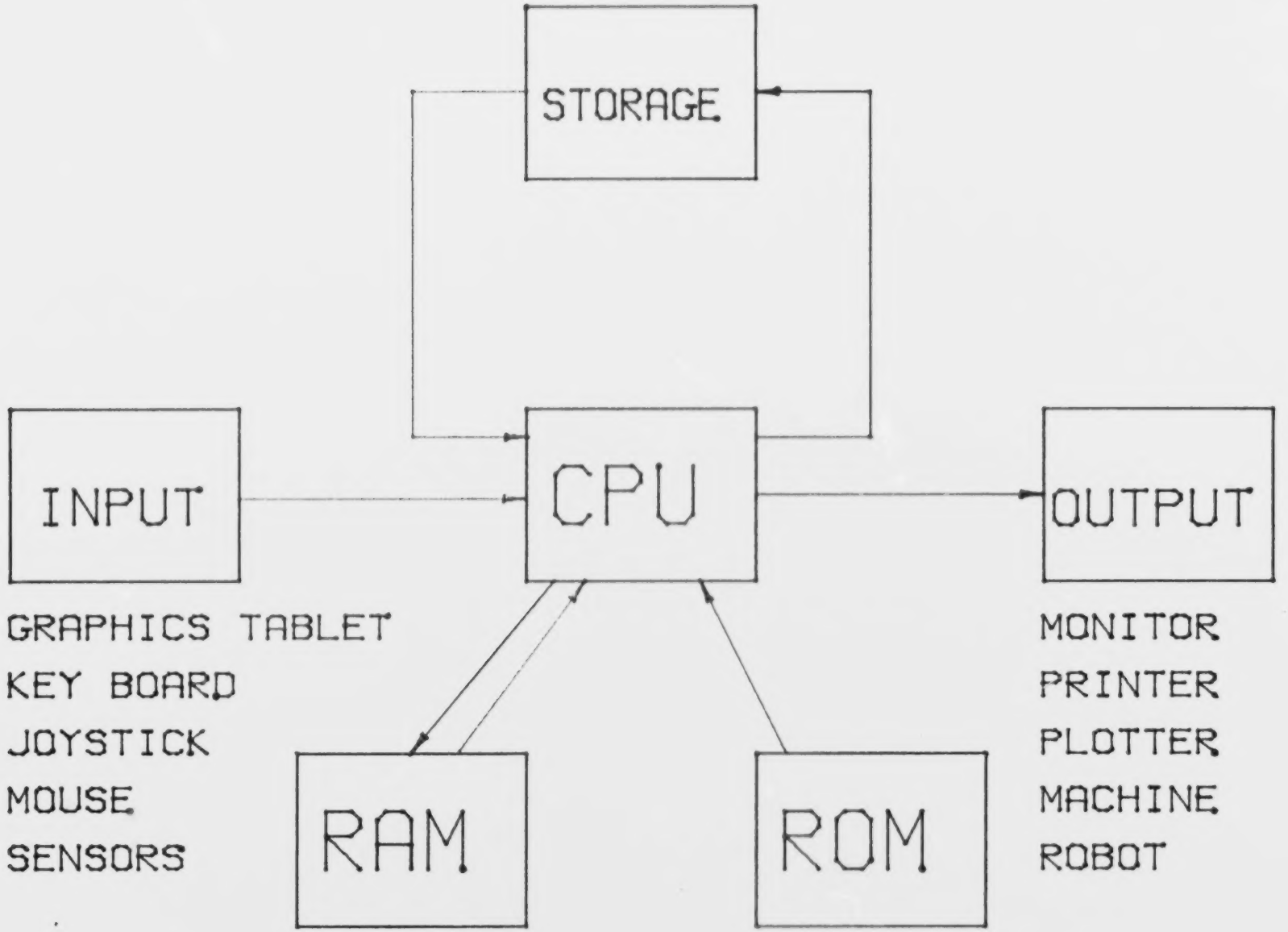
```
JOHN SMITH
INDUSTRIAL ARTS CLASS
5TH HOUR
NOV. 10, 1986
```

8. If there is something wrong with your hello message, type the word LIST and press the return key. This command will display your hello program. Check the program for mistakes. If you find the problem, retype the whole line. Your computer is very dumb, so if you do not tell it exactly what to do, it will not work. If you cannot find the problem, ask your teacher for help.

9. Once you make corrections, type the word RUN and press the return key. Your hello program should be displayed in the upper left part of the screen. If there is still something wrong with the hello program, go back to step number 8 and try again.

10. When your hello program works, type SAVE HELLO and press the return key. This will save your hello program in the first storage space on your diskette.

11. To make sure you save your program, type CATALOG and press the return key. This command will display the catalog which contains your hello program. As you write more programs, the list of programs in the catalog will grow longer.


STORAGE
INPUT
CPU
OUTPUT
GRAPHICS TABLET
KEY BOARD
JOYSTICK
MOUSE
SENSORS
RAM
ROM
MONITOR
PRINTER
PLOTTER
MACHINE
ROBOT

OT #2-1

UNIT: Exploring Computer Technology

LESSON 3: Computer Languages and Software

Objectives	Lesson Content	Learning Activities	References
A. Following a class discussion, students will be able to identify: -the difference between high-level and machine language. -applications for the four basic types of computer programming languages. -the function of given commands in the BASIC computer language.	A. Computer Software 1. elements in a computer system. a. hardware (the physical devices) b. software (the set of step by step instructions given to the computer hardware to perform a specific task). 2. types of computer languages a. machine b. high-level 3. machine language a. the only language the computer understands b. uses binary numbers (a series of 1s and 0s) c. one binary digit is called a bit d. a group of binary digits (bits) are called a byte	A. Teacher Guided Discussion 1. Review the elements of a computer system. 2. Discuss the concept of a computer program or software. 3. Explain how a computer program is a logical and sequential series of instructions given to a computer to perform a task. 4. Show students a computer listing. 5. Explain how programs are written in different languages depending on application. 6. List and discuss the applications for the four most common computer languages.	TA #3-1: Computer Software and Languages HO #3-1: Computer Languages and Software

4. high-level language
   a. use English language type statements
   b. the computer must convert high-level language into machine language
5. Basic
   a. an acronym for **B**eginner's **A**ll-purpose **S**ymbolic **I**nstruction **C**ode
   b. the most commonly used high-level language
   c. used mostly on microcomputers
6. Cobol
   a. an acronym for **CO**mmon **B**usiness **O**riented **L**anguage
   b. a high-level language developed for business applications
7. Fortran
   a. an acronym for **FOR**mula **TRAN**slator
   b. a high-level language used primarily for scientific and engineering applications

8. Logo (the only high-level language developed specifically for education and children)

B. Following a demonstration, students will be able to:
-start a new program.
-use line number to enter and edit a program.
-apply the function of given commands in the BASIC computer language.
-list, run, and save a program.

B. Entering a Program:
1. how to start a new program
2. how to use line numbers
3. how to use commands in BASIC
   a. REM
   b. HOME
   c. PRINT
   d. numeric variables
   e. string variables
   f. INPUT
   g. FOR/NEXT loops
   h. GOTO
   i. IF/THEN
   j. VTAB AND HTAB
4. how to list a program
5. how to run a program
6. how to edit a program

B. Student Learning Activity
1. Explain and demonstrate how to start a new program, how to use line numbers, how to run a program, how to list a program, and how to edit a program.
2. Explain the function of the simple commands in the Basic computer language.
3. Have students enter the introduction program included in these materials.
4. After they have entered their first program, teach students to save their program, empty the memory, find their program in the catalog, and load their program back into the computer.
5. When each student has been successful with the activities listed above, allow them to enter, save, and experiment with the other example programs provided at their own pace.
6. Collect the disks at the end of the class period.
7. Review and evaluate each student's disk in terms of their progress and programming accuracy.

COMPUTER SOFTWARE AND LANGUAGES

Introduction:

Review the basic elements in a computer system. Describe a computer system as a collection of devices (hardware) and instructions (software) that function together to process information. Describe a program as a logical and sequential series of instructions given to computer hardware to perform a task. Explain why it is important for the steps to be in sequential and logical order. A way of reinforcing the need for sequential and logical steps is to have a student perform a task according to your verbal instructions. Make your instructions step by step like a computer program. Have the students execute each instruction before providing them another. When a student uses his or her own judgement while performing the task, have the student stop and point out what happened. Emphasize the fact that a computer cannot think and that they will need to tell it every step and take nothing for granted. Provide the student with an incorrect instruction and see what happens. Discuss the student's performance due to an incorrect instruction in comparison to what happens if a computer is given incorrect instructions.

Show students a computer listing and ask them if it looks like a foreign language. Explain how programs are written in different languages depending on the task. Explain that there are two basic types of computer languages, machine language and high-level language. Discuss how the only language the computer understands is machine language. Describe machine language as a series of 1s and 0s called binary numbers. Define one binary digit as a bit and a fixed number of binary digits (bits) handled by the computer as a group is called a byte.

Discuss the concept of high-level computer languages. Explain how high-level languages use English-like statements to communicate with the computer. Make sure the students understand the computer must still convert the high-level language to machine language before it can perform a task.

List on the chalk board four of the common high-level computer languages (Basic, Cobol, Fortran, and Logo). Discuss where their names came from and the basic applications.

Student Learning Activity:

Review how to load, list, run, edit, and save a computer program. Explain and demonstrate how to start a new program, how to use line numbers, how to run a program, how to list a program, and how to edit a program.

Explain the function of the simple commands in the Basic computer language. Include in your discussion commands like rem, home, print, numeric variables, string variables, input, for/next, goto, if/then, vtab, and htab.

Have your students enter the introduction program included in these materials. After they have entered their first program, for the purpose of review, have students save their program, empty the memory, find their program in the catalog, and load it back into the computer.

When each student has been successful with the introduction program, have them enter a simple program exemplifying how various commands in the Basic language work. Possible example programs have been included in these materials. If you have students with programming experience, (you may have several) have them modify and/or expand the programs. Another option for experienced programmers is to have them coach the other students. Students enjoy teaching their peers how to program a computer. Allow students to progress through the example programs at their own pace.

Collect the disks at the end of the class period. Review the programs and make sure they work. Evaluate each student's disk in terms of their progress and how accurately they entered the programs.

INTRODUCTION PROGRAM

```
10 REM **********************
20 REM INTRODUCTION PROGRAM
30 REM BY _____________
40 REM **********************
50 HOME
60 PRINT "WHAT IS YOUR NAME?"
70 INPUT N$
80 VTAB 10: HTAB 10
90 PRINT "HELLO, ";N$
100 END
```

COMPUTER LANGUAGES AND SOFTWARE

Introduction:

You have learned that a computer system is a collection of devices (hardware) and procedures (software) that work together to process information. You have learned that hardware is the physical part of the computer system. Computers are very stupid; they cannot think. In order to perform a task, they must be told every step. A series of step by step instructions that tell the computer hardware what to do is called computer "software" or a "program." The instructions given to the computer must be complete, in order, and logical. Without software, a computer is useless. A computer system is only as good as its software or programming.

How do you tell a computer what to do? You have to talk to it in its own language. There are two basic kinds of computer languages. The first one is called machine language. Machine language is the only language the computer really understands. Machine language is basically a series of 1s and 0s called binary numbers. The binary "1" and "0" turn electronic switches on (1) and off (0). The computer processes information by connecting a series of these electronic switches in patterns. One binary digit is called a "bit." A group of 8 binary digits (bits) is called a byte. A school computer can often store 64k, or 64,000 bytes in its memory.

Few people really know machine language well enough to program a computer. Most people program computers with a "high-level" computer language. High-level computer languages are more like English than machine language is. However, the computer must convert the high-level language into machine language before it can perform the desired task. A program written in even a high-level language still looks like a foreign language to most people. Look at the example below.

```
430 PRINT "4. A.";
435 DIM R$(10)
440 INPUT R$
445 IF R$(1,1)="F" THEN 495
450 GOSUB 1180
455 GOTO 465
```

There are four basic types of high-level languages. The example in the preceding page is written in BASIC. BASIC is an acronym for Beginner's All-purpose Symbolic Instruction Code. This is the most commonly used high-level language for microcomputers.

Another common high-level computer language is called COBOL. COBOL is an acronym for COmmon Business Oriented Language. This high-level language was developed for business applications.

FORTRAN is a language designed primarily for scientific and engineering applications. It is an acronym for FORmula TRANslator.

LOGO is the only computer language developed specifically for children and education. It is a very easy to learn and use high-level language. Students often write programs in LOGO to draw designs and pictures on the screen.

Exploring Basic:

By learning a few commands in the BASIC you can become a computer programmer. You will be able to program a computer to solve industrial problems. The best way to learn commands is to use them on the computer. Before you start programming, you may want to review your operating commands. Listed below are the basic operating commands and what they do.

]	prompt character - means your computer is ready for you to input information or commands
RETURN	used to issue a command to the computer - it is also used to end a statement line and begin a new one
LIST	will display a list of the programs currently in the memory on the monitor screen
RUN	will execute (run) the program currently in the memory
NEW	clear the memory so a new program can be entered
LOAD	loads (or moves) a program into the memory from the diskette
SAVE	saves (or stores) the program currently in memory on to a diskette

CATALOG	shows you a list of the programs stored on the diskette (a table of contents for the disk)
--->	moves the input cursor (the winking checkered box) to the right
<---	moves the input cursor (the winking checkered box) to the left

REM and PRINT:

The first commands you will explore are REM and PRINT. The REM command allows you to put remarks or notes in your program. The computer will not try to read the information you put after a REM command. If you wanted to put your name in a program, you would need to type a line number, REM, and your name (10 REM JOHN SMITH). Your name would not appear on the screen when you run the program.

The PRINT command will display text on the screen. If you wanted a message to appear on the screen, you would need to type a line number, PRINT, and your message in quotes (10 PRINT "ACME JR. HIGH RULES"). If you do not want to type PRINT every time you want text to appear on the screen, use a question mark (?) instead of PRINT. When you LIST your program, the computer will type command PRINT where it finds your question marks.

Let's get started. Boot your diskette by putting it in the disk drive and turning on the computer. When the disk drive stops, you should see your hello message on the screen. Type the word NEW and press return. Enter and run the introduction program listed below. Remember, your computer is stupid. You have to tell it everything. Type the program exactly as it is listed below.

```
 10 REM  **********************
 20 REM  INTRODUCTION PROGRAM
 30 REM  BY _____________
 40 REM  **********************
 50 HOME
 60 PRINT "WHAT IS YOUR NAME?"
 70 INPUT N$
 80 VTAB 10:  HTAB 10
 90 PRINT "HELLO, ";N$
100 END
```

Using PRINT and MATH Statement:

The introduction program is still on the screen. Before we can explore a new command, you will need to clear the screen. Type the word HOME and press the return key. The command HOME clears the screen. However, your first program is still in the computer's memory. Type the word RUN. See what I mean? Clear the screen by typing HOME, press return, type the word NEW, and press return. Now the screen and the memory are both empty. Type the program listed below exactly as it is listed.

```
 10 REM ****************
 20 REM USING PRINT AND
 30 REM MATH STATEMENTS
 40 REM ****************
 50 HOME
 60 PRINT "ADDITION PROBLEM: 28+49"
 70 PRINT "THE ANSWER IS ";28+49
 80 PRINT
 90 PRINT "SUBTRACTION PROBLEM: 83-47"
100 PRINT "THE ANSWER IS ";83-47
110 PRINT
120 PRINT "MULTIPLICATION PROBLEM: 19*51"
130 PRINT "THE ANSWER IS ";19*51
140 PRINT
150 PRINT "DIVISION PROBLEM: 73/14"
160 PRINT "THE ANSWER IS ";73/14
170 END
```

When you are done entering the program, type RUN and press the return key. You should notice several things. Your REM statements did not appear on the screen. Secondly, when you typed the math problems inside the quotes they were printed on the screen. When you typed the math problems outside the quotes, the computer printed the answer. Thirdly, when you typed the command PRINT by itself, it left a handy space on the screen. Lastly, you can add with a + sign, subtract with a - sign, multiply with an *, and divide with a / mark.

Using Numeric Variables:

Numeric variables allow you to store a number in a storage space. You can give the storage space a one or two letter name (for example A). If you wanted to store the number 5 in storage space A, you would type A=5 after a line number. Every time you use the name (A), the computer goes to the storage space and gets the number you stored in it (5). Try using numeric variables by entering and running the following program. You may want to try putting diffe-

rent numbers in the storage places B and C. Try calling the storage places X and Y if you want.

```
10 REM ************************
20 REM USING NUMERIC VARIABLES
30 REM ************************
40 HOME
50 B=25
60 C=41
70 PRINT B+C
80 END
```

Using String Variable and Input Statements

String variables work alot like numeric variables. The difference is that you use string variables to put words instead of number in a storage place. To make sure the computer knows you are storing words, you use a letter followed by a dollar sign ($) when naming the storage place. String variables are often used to provide a storage space for an answer to a question. When a program asks the computer user a question, the computer has to have a storage space for the answer that is typed in. The command that allows the user to type something is called INPUT. Try using a string variable and an input statement by entering and running the program listed below.

```
10 REM ************************
20 REM USING STRING VARIABLES
30 REM ************************
40 HOME
50 PRINT "WHAT IS THE NAME OF YOUR SCHOOL TEAM?"
60 INPUT N$
70 PRINT "THE ";N$;" ARE NUMBER ONE"
80 END
```

Using A FOR/NEXT Loop:

Sometime when you are writing a program, you want the computer to count from one number to another. Type and run the program listed below.

```
10 REM ***********************
20 REM USING A FOR/NEXT LOOP
30 REM ***********************
40 HOME
50 PRINT "LOOK MOM, I GOT STRAIGHT A'S"
60 FOR X = 1 TO 1000
70 NEXT X
80 FOR X = 1 TO 20
90 HTAB 26
100 PRINT "A"
110 NEXT X
120 END
```

How many "A's" did you get? How did the computer know to give you 20 A's? I bet you are glad you do not have 20 classes. You used a FOR/NEXT loop for two applications in this program. In line 60 you told the computer that the numeric variable "X" was first equal to "1" (FOR X = 1 to 1000). In line 70, you told the computer to go to the "NEXT X." The computer went back to line 60 and made "X" equal to 2 and then it went back to line 70. Line 70 told the computer to go to the NEXT X. This made X equal to 3 in line 60. This process continued until the computer reached 1000 (FOR X = 1 TO 1000). After the computer counted to 1000, it progressed to line 80. On the screen lines 60 and 70 looked like a pause. Creating a pause on the screen is one of the applications for a FOR/NEXT loop.

In lines 80, 90, 100, and 110, you told the computer to print an "A" on the screen 20 times. Line 80 told the computer X was equal to 1. Then the computer went to line 90 and 100 where it was told to print an "A" in a given location on the screen. In line 110, you told the computer to go to the next value of X (2). The computer continued this process until it counted to 20 and printed 20 "A's" on the screen. The second application for FOR/NEXT loops is to tell the computer to repeat a task (like printing "A's") a given number of times.

Using a GOTO Loop:

Another way to tell a computer to repeat something over and over again is to use a GOTO command. Let's say the computer has read line 10 to 50 and you want it to do it over again. In line 60, you would tell the computer to GOTO 10. When the computer reads line 60 it will go to line 10 and start over again. Unfortunately, your computer is stupid: it will keep going back to line 10 until you tell it to stop. If you want a computer to stop in the middle of a program, you have to push the control key and the letter C at the same time. Enter and run the program listed below. You will need to hold the control and press the letter C to stop the program.

```
 10 REM ************************
 20 REM PUTTING IT ALL TOGETHER
 30 REM ************************
 40 HOME
 50 PRINT "WHAT IS YOUR NAME?"
 60 INPUT N$
 70 HOME
 80 PRINT "*** ";N$;" IS A PROGRAMMER ***"
 90 PRINT
100 FOR X = 1 TO 1000
110 NEXT X
120 GOTO 80
130 REM  YOU WILL NEED TO
```

```
140 REM  PRESS THE CONTROL
150 REM  KEY AND THE LETTER
160 REM  C TO STOP THE
170 REM  PROGRAM.
```

Using VTAB and HTAB:

When writing a program, you often want to arrange the information on the screen so it looks good. This is called formatting. The basic commands used to format (arrange information on the screen) are VTAB and HTAB. You have entered several programs using these two commands. The "V" in VTAB stands for vertical (up and down). Your computer has 24 lines on the screen. The computer automatically starts displaying information on the top line and works its way down the screen. However, if you want to print a message halfway down the screen, you would type a line number followed by VTAB 12. The next line in the program would include the print command and the message in quotes. When the computer reads the program it would be told to go halfway down the screen. Then it would be told to print the message.

The "H" in HTAB stands for, you guessed it, horizontal. Your screen has 40 columns (spaces) for 40 characters (letters) per line across the screen. If you wanted to print your name in the middle of the screen, you would type a line number followed by VTAB 12, a colon (:), and HTAB 12. The next line number would be followed by the PRINT command and your name in quotes. When the computer reads the program, VTAB 12 would tell the computer to move halfway down the screen and HTAB 12 would tell the computer to move over 12 spaces from the left side of the screen. The PRINT command in the next line would put your name on the screen. To keep the VTAB and HTAB commands separate, you need to type a colon (:) between them (VTAB 12:HTAB 12). Enter and run the program listed below.

```
 10 REM ****************************
 20 REM USING VTAB & HTAB STATEMENT
 30 REM ****************************
 40 HOME
 50 VTAB 5: HTAB 5
 60 PRINT "INDUSTRIAL"
 70 VTAB 10: HTAB 15
 80 PRINT "ARTS"
 90 VTAB 15: HTAB 20
100 PRINT "IS GREAT!!!"
110 END
```

Using IF/THEN Statements:

Sometimes information processing requires a decision to be made in the program. The command used for making decisions is called an IF/THEN statement. The IF/THEN statement tells the computer to do one thing under one condition and something else under a different condition. IF your homework is done, THEN go outside. IF your homework is not done, THEN go do it. To make a decision in the program, IF/THEN statements are often included in a string variable and a GOTO statement. Enter and run the program listed below. Notice how the program will jump to given lines depending on the input.

```
 10  REM  ************************
 20  REM  USING IF/THEN STATEMENTS
 30  REM  ************************
 40  HOME
 50  PRINT "OTHER THAN LUNCH, INDUSTRIAL ARTS IS"
 60  PRINT "THE BEST CLASS OF THE DAY (T OR F)"
 70  INPUT A$
 80  IF A$ = "T" THEN GOTO 100
 90  IF A$ = "F" THEN GOTO 120
100  PRINT "YOU KNOW WHERE THE ACTION IS"
110  END
120  PRINT "THERE IS NO ACCOUNTING FOR TASTE"
130  END
```

UNIT: Computer Technology

LESSON 4: Program Planning

Objectives	Lesson Content	Learning Activities	References
A. Following a discussion, students will be able to: -explain why programs need to be planned before they can be written -list the basic questions that need to be answered to plan a program. -identify the two basic methods used to plan a computer	A. Program Planning 1. Proper prior planning prevents poor performance. 2. Poor planning wastes: a. time b. money c. human resources d. computer resources 3. Planning questions required to solve the problem? b. What order do the steps need to be in? c. What do I want the computer to do? 4. Planning methods a. flowcharting (making a pictorial chart showing how the program will work) b. pseudo code (writing a program using the English statements)	A. Teacher Guided Discussion 1. Discuss the importance of good planning before beginning a project. 2. Explain how poor planning wastes time, money, human potential, and computer resources in industry. 3. Using OT #4-1, discuss how programs can be planne . 4. Discuss how and why computer programs are often written in English before they are written in a computer language.	TA #4-1: Program Planning OT #4-1

B. During a lab activity, following a demonstration, students will be able to: -analyze a written problem. -break the problem down into specific tasks for the computer. -put the tasks in logical and sequential order. -write a program to solve the problem using English statements.	B. Planning a Program 1. analyzing the problem 2. identifying steps 3. identifying tasks for the computer 4. writing a program using English statements	B. Learning Activity 1. Using the example problem, discuss how to break the problem down into steps, how to put the steps in order, and how to write a computer program using English statements. 2. Provide students with HO #4-1. 3. Have students choose one of the problems provided for their computer programming projects. 4. Have the students break the problems down into a series of steps and write a program using English statements. 5. At the end of the period, collect the pseudo programs. Evaluate each program in terms of their problem solving potential and programming accuracy.	HO #4-1: Program Planning

PROGRAM PLANNING

Introduction:

When exploring computer technology, computer programming must be kept in perspective. Less than 10 percent of the people who use computers in industry need to know how to program them. But, the ability to give instructions to a computer programmer is something everyone should be able to do. A computer programming experience helps students understand how a computer works, the limitations of the hardware, and why the power of computer technology lies with people. Computer programming also helps the student develop problem-solving skills, an ability to think logically, and an appreciation for software.

Discuss the importance of good planning before beginning a project. Have students cite examples of what happens when a project is started without proper planning. Explain how poor planning wastes time, money, human potential, and computer resources in industry. Discuss why computer programmers spend as much, if not more, time planning a program with a pencil and paper than they do entering it into the computer.

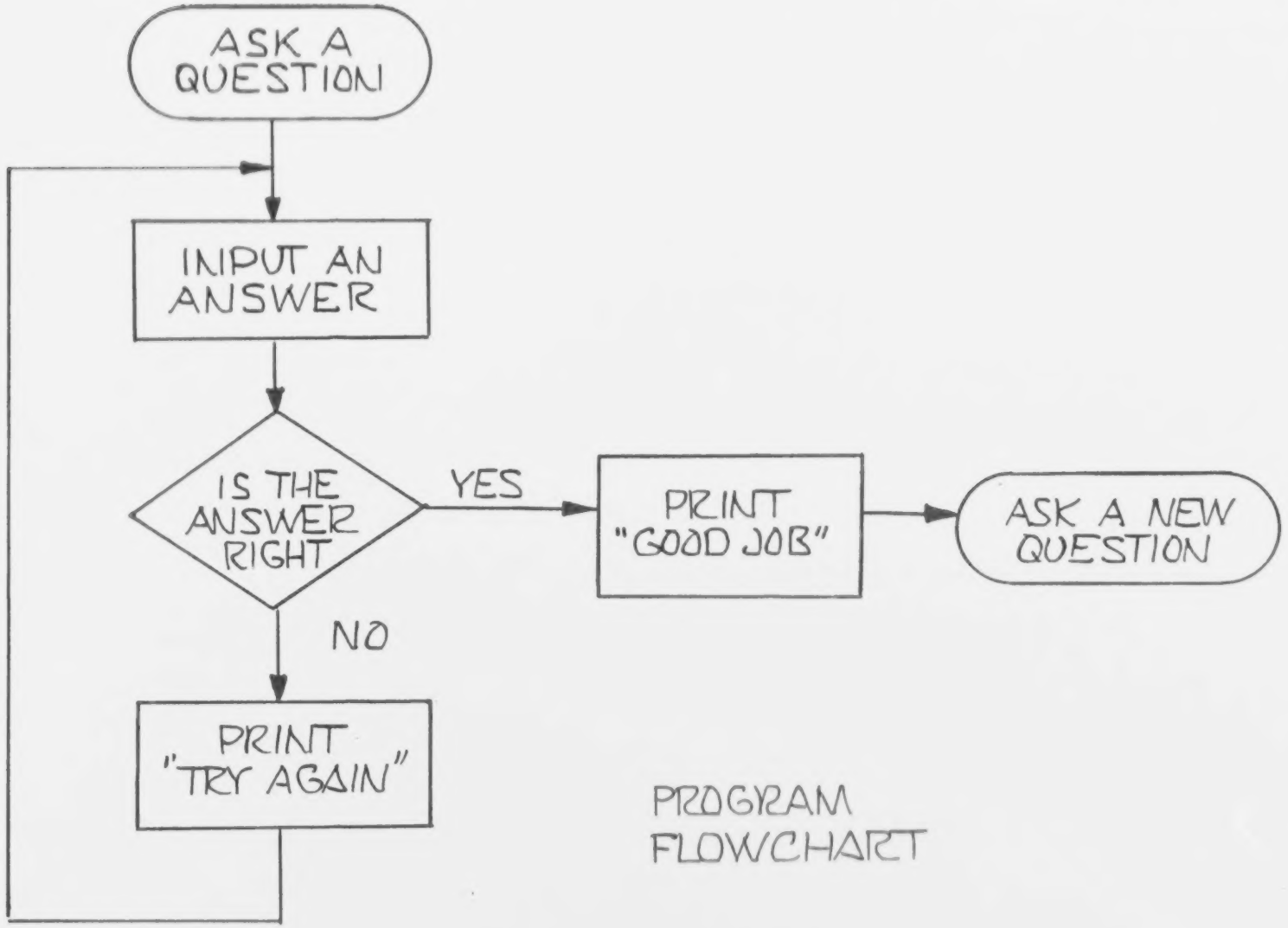
Illustrate how the plans for a computer program are often drawn in the form of a flowchart. If you want, explain the meaning of each basic symbol in a computer flowchart. However, computer flowcharting may be difficult for your students to understand. The learning activity has been therefore designed around a concept often called "pseudo coding" (writing a computer program using English statements before it is written in a computer language). You might want to put more emphasis on discussing this method of planning a computer program.

Using the example provided, demonstrate and discuss how to plan a computer program in order to solve a problem. List on the chalk board the questions that need to be answered when planning a computer program. During the discussion, ask students to list the steps required to solve the problem. After the steps have been listed, have them put the steps in a sequential order. Use line numbers when sequencing the steps. Make sure the list of steps include things that the computer will need to do (like clear the screen, move to the center of the screen, etc.). Test the pseudo programs by acting them out on the chalk board. Have students fill in and refine the missing steps.

Student Learning Activity:

Provide the students with a list of problems. Allow them to choose one of the problems for their computer programming project. You may want to consider having the students work in groups, after all, few people work by themselves in industry. The students in each group would work together to write a pseudo program for a given problem.

Have each student/group break their problem down into a series of steps and write a computer program using English statements. At the end of the period collect the pseudo codes. Evaluate each program in terms of their problem solving potential and programming accuracy.



PROGRAM FLOWCHART

OT #4-1: Program Flowchart

PROGRAM PLANNING

Introduction:

You have learned that a computer is really a very stupid machine. It cannot think; you have to do all the thinking for it. You must tell it exactly how to process information. If you make one little mistake in telling it what to do, it will not process the information correctly. A computer system is only as good as the instructions (programming) given to it. If you tell it what to do, it can handle more information and process it faster than you can.

Like any other project, programming requires good planning. Proper prior planning prevents poor performance. In industry, poor planning wastes time, money, human resources and computer resources. Computer time is too important and expensive for it to be wasted. Computer programmers spend more time planning their programs on paper than they do entering them on the computer. If a program is planned properly, the program will not need trouble shooting and refining.

There are two basic ways of planning a computer program. The first one is called flowcharting. Flowcharting is basically drawing a picture or chart of how the program will work. Symbols are used to represent commands. The following flowchart example illustrates a computer program.

Another common method used to plan a computer program is called "pseudo (pretend) code." Bascially, pseudo code is a computer program written in English statements. After the computer program has been planned, the English statements can be converted into a computer language. This is a very efficient means of designing a computer program. Most of the people who use computers do not program them. However, everyone who uses a computer should be able to tell a computer programmer what they need a computer to do. For most people, being able to design a program using English statements is more important than being able to write the program in a computer language.

The first step in planning a computer program is to analyze the problem that needs to be solved. When planning a program, there are three basic questions to asked: What are the steps required to solve the problem? What order do the steps need to be in? What do I want the computer to do? Look at the example provided. Notice how the questions were answered and how the program evolved.

Example Problem:

Write a computer program that estimates the cost of a project based on the number of linear feet entered and the entered cost of material per linear foot.

Question 1: What are the steps required to solve the problem?

* Multiply the amount of material needed by the cost of the material
* Ask how many feet of material is needed for the project
* Ask how much the material will cost per foot
* Tell the user the cost of the project

Question 2: What order do the steps need to be in?

1. Ask how many feet of material is needed for the project.
2. Ask how much the material will cost per foot.
3. Multiply the amount of material needed by the cost of the material.
4. Tell the user the cost of the project.

Question 3: What do I want the computer to do?

```
 10  clear the screen
 20  tell the user the purpose of the program
 30  leave a space
 40  ask the user how many feet of material will the
     project require
 50  allow the user to enter the number of feet
 60  leave a space
 70  ask the user how much the material costs per foot
 80  allow the user to enter the cost
 90  multiply the amount of material needed by the cost
     of the material
100  leave a space
110  tell the user how much the project will cost
120  end the program
```

COMPUTER PROGRAMMING PROJECT

Directions:

Circle your choice of one of the programming problems listed below for your computer programming project. Write the answer to the program planning questions in the spaces provided. Use the example provided as a guide while planning your program.

1. Write a computer program that estimates the cost of a house based on the entered cost per square foot and the entered number of square feet.

2. Write a computer program that illustrates a graphic and/or written message on the screen like an electric sign.

3. Write a computer program that provides the user with a multiple choice question, allows the user to make a choice, and provides the user with appropriate feedback depending on their choice.

4. Write a computer program that determines net profit based on entered costs, the number of products sold, and the price of each product.

5. Write a computer program that calculates the number of miles per gallon that a car gets based on the entered number of miles driven and the number of gallons of gas used.

6. Write a computer program that draws a logo on the screen and can be used for a hello program on a diskette.

Question 1: What are the steps required to solve the problem?

* _____

* _____

* _____

* _____

* _____

Question 2: What order do the steps need to be in?

1. _____

2. _____

3. _____

4. _____

5. _____

Question 3: What do I want the computer to do?

10 _____

20 _____

30 _____

40 _____

50 _____

60 _____

70 _____

80 _____

90 _____

100 _____

110 _____

120 _____

130 _____

140 _____

150 _____

UNIT: Exploring Computer Technology

LESSON 5: Writing a Program in Basic

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -the three basic considerations when writing a computer program. -the sequence of steps needed to write a program.	A. Writing a Computer Program 1. encoding (converting a program written in English to one written in Basic) 2. programming considerations a. documentation b. formatting c. user friendly 3. documentation a. REM statements b. name of the program c. label sections of the program 4. formatting a. VTAB, HTAB and PRINT statements b. making output look good on the screen 5. user friendly a. tell the user about the program b. easy to read and understand statements c. the program is easy to use	A. Teacher Guided Discussion 1. Discuss how a computer program is written in English, must be encoded into a language the computer can understand. 2. Review the procedure for starting a new program, using line numbers, listing a program, running a program and editing a program. 3. Discuss the importance of documentation, formatting and user friendliness when writing their program.	TA #5-1: Writing a Program in Basic.

B. During a lab activity, following a demonstration, students will be able to:
- -encode a program written with English statements into the Basic computer language.
- -document the program for easy understanding.
- -format the program so it looks good on the screen.
- -enter, test, and trouble-shoot the program.
- -refine the program so it is user friendly.

B. Programming in Basic
1. encoding
2. entering
3. testing
4. trouble-shooting
5. refining
6. saving

B. Learning Activity

1. Using the example program, demonstrate how to convert the English statements into commands in the Basic Computer language.	OT #5-1 OT #5-2
2. Explain how to include documentation, formatting, and user friendliness when writing a program.	
3. Give students HO #5-1.	HO #5-1: Writing a Program in Basic.
4. Have students translate their programs written in English to programs written in Basic.	
5. Have students enter, test, and trouble-shoot their programs.	
6. Provide individual instruction as needed.	
7. At the end of the period, collect the diskettes. Review and evaluate each program in terms of their problem solving, documentation, formatting, user friendliness, and programming accuracy.	

WRITING A PROGRAM IN BASIC

Introduction:

After most of your students have finished planning their programs, introduce them to converting their programs written in English into programs written in Basic. Review the concept of talking to the computer in a language it can understand. Using OT #5-1 and OT #5-2, explain how to convert each statement to Basic line by line.

Discuss the importance of documentation, formatting and user friendliness when writing a computer program. Show how REM statements were used to document the example program. Explain how the documentation provides information regarding the program, the author, and how the program works.

Describe the goal of formatting as that of making output look good on the screen. Review how the screen is laid out in rows and columns. Discuss how the VTAB, HTAB and PRINT commands can be used to format a program on the screen. Show students how Print statements were used to format the example program.

Discuss the concept of making a computer program user friendly. Explain how the program should introduce the user to the program, be easy to read, and easy to follow.

If necessary, review the procedure for starting a new program, using line numbers, listing a program, running a program, and editing a program.

Student Learning Activity:

Provide students with HO #5-1 and return program planning activity (HO #4-1). Program listings have been provided for each of the programming problems in these materials. These listings represent one possible programming solution to the programming problems. However, they may be a valuable resource when facilitating this activity.

You may want to make sure students have their example programs for commands in basic (HO #3-1). The example programs might be a help resource when they write their programs. Your primary goal is for the students to experience and understand the programming process. If they learn some Basic in the process, that is great. Allow them to copy sections from the examples. It is a common practice in industry to write programs by putting subprograms together; very rarely are programs written from scratch.

Have students translate their programs written in English to programs written in Basic. Before the students

use the computer, check their programs to make sure they are developed. (They do not need to be perfect.) You want to prevent inefficient hacking on the computer. After their programs have been approved, have students enter, test, and trouble-shoot their programs. Many of your students will need individual instruction regarding the trouble-shooting and refinement process. If it is appropriate, have students who finish early
help their peers trouble-shoot and refine their programs.

At the end of the period, collect the diskettes. Review and evaluate each program. Put emphasis on their problem solving ability, documentation, formatting, user friendliness, and programming accuracy.

```
10  REM  ******************************
20  REM  EXAMPLE PROGRAM #5 FOR THE
30  REM  COMPUTER PROGRAMMING PROJECT
40  REM  ******************************
50  HOME
60  PRINT "THIS PROGRAM WILL FIGURE"
70  PRINT "YOUR GAS MILEAGE."
80  PRINT : PRINT
90  PRINT "HOW MANY MILES DID YOU DRIVE?"
100 INPUT M
110 PRINT : PRINT : PRINT
120 PRINT "HOW MANY GALLONS OF GAS"
125 PRINT "DID YOU USE?"
130 INPUT G
140 PRINT : PRINT : PRINT
150 GM = M / G
160 PRINT "YOU GOT ";GM;" MILES PER GALLON."
170 END
```

```
10  REM  ******************************
20  REM  EXAMPLE PROGRAM #6 FOR THE
30  REM  COMPUTER PROGRAMMING PROJECT
40  REM  ******************************
50  HOME
55  REM  DRAW A BOX ON THE SCREEN
60  VTAB 2
70  PRINT "*******************************************"
80  FOR X = 1 TO 18
90  PRINT "*                                         *"
100 NEXT X
110 VTAB 20
120 PRINT "*******************************************"
125 REM  PUT INFORMATION IN THE BOX
130 VTAB 5: HTAB 8
140 PRINT "ACME JUNIOR HIGH SCHOOL"
150 VTAB 6: HTAB 12
160 PRINT "INDUSTRIAL TECHNOLOGY"
170 VTAB 12: HTAB 9
180 PRINT "JOHN SMITH'S PROGRAMS"
190 VTAB 17: HTAB 6
200 PRINT "TYPE CATALOG AND PUSH RETURN"
210 END
```

```
10  REM  ******************************
20  REM  EXAMPLE PROGRAM #1 FOR THE
30  REM  COMPUTER PROGRAMMING PROJECT
40  REM  ******************************
50  HOME
60  PRINT "THIS PROGRAM WILL ESTIMATE THE"
70  PRINT "COST OF BUILDING A HOUSE BASED"
80  PRINT "ON THE NUMBER OF SQUARE FEET."
90  PRINT : PRINT : PRINT
100 PRINT "HOW MANY SQUARE FEET WILL THE"
105 PRINT "HOUSE BE?"
110 INPUT SF
120 PRINT : PRINT : PRINT
130 PRINT "WHAT IS THE COST OF CONSTRUCTION"
140 PRINT "PER SQUARE FOOT?"
150 INPUT C
160 TC = SF * C
170 PRINT : PRINT : PRINT
180 PRINT "THE HOUSE WILL COST ABOUT $";TC
190 PRINT "TO BUILD."
200 END
```

```
5   HOME
10  REM  ******************************
20  REM  EXAMPLE PROGRAM #2 FOR THE
30  REM  COMPUTER PROGRAMMING PROJECT
40  REM  ******************************
50  PRINT : PRINT : PRINT
55  HTAB 8
60  PRINT "****************************"
65  HTAB 8
70  PRINT "THINK TECHNOLOGY EDUCATION"
75  HTAB 8
80  PRINT "****************************"
90  FOR X = 1 TO 1000
100 NEXT X
110 GOTO 50
120 REM YOU WILL NEED TO PUSH
130 REM  THE CONTROL AND THE
140 REM C KEY TO STOP THE
150 REM PROGRAM
```

```
10  REM  ******************************
20  REM  EXAMPLE PROGRAM #3 FOR THE
30  REM  COMPUTER PROGRAMMING PROJECT
40  REM  ******************************
50  HOME
60  PRINT "THE COMMAND USED TO PUT NOTES"
70  PRINT "IN A PROGRAM IS CALLED A
80  PRINT "_________________ STATEMENT."
90  PRINT : PRINT
100 PRINT "A. PRINT"
110 PRINT "B. REM"
120 PRINT "C. HOME"
130 PRINT "D. NOTE"
140 PRINT : PRINT
150 PRINT "TYPE A, B, C, OR D"
160 INPUT A$
170 PRINT
180 IF A$ = "A" THEN 230
190 IF A$ = "B" THEN 250
200 IF A$ = "C" THEN 230
210 IF A$ = "D" THEN 230
230 PRINT "INCORRECT, PLEASE TRY AGAIN"
240 GOTO 160
250 PRINT "GOOD JOB!!!"
260 END
```

```
10  REM  ******************************
20  REM  EXAMPLE PROGRAM #4 FOR THE
30  REM  COMPUTER PROGRAMMING PROJECT
40  REM  ******************************
50  HOME
60  PRINT "THIS PROGRAM WILL FIGURE GROSS"
70  PRINT "PROFIT BASED ON THE NUMBER OF"
80  PRINT "PRODUCT SOLD, THE COST TO MAKE"
90  PRINT "EACH PRODUCT, AND THE PRICE OF"
100 PRINT "EACH PRODUCT."
110 PRINT : PRINT
120 PRINT "HOW MANY PRODUCTS WERE SOLD?"
130 INPUT S
140 PRINT : PRINT
150 PRINT "HOW MUCH DID IT COST TO MAKE"
160 PRINT "EACH PRODUCT?"
170 INPUT C
180 PRINT : PRINT
190 PRINT "WHAT WAS THE PRODUCT'S SELLING"
200 PRINT "PRICE?"
210 INPUT P
220 PRINT : PRINT
230 GP = (P - C) * S
240 PRINT "YOUR GROSS PROFIT IS: $";GP
250 END
```

EXAMPLE PROBLEM

Write a computer program that estimates the cost of a project based on the number of linear feet entered and the entered cost of material per linear foot.

Question 1: What do I want the computer to do?

A. clear the screen
B. tell the user the purpose of the program
C. leave a space
D. ask the user how many feet of material will the project require
E. allow the user to enter the number of feet
F. leave a space
G. ask the user how much the material costs per foot
H. allow the user to enter the cost
I. multiply the amount of material needed by the cost of the material
J. leave a space
K. tell the user how much the project will cost
L. end the program

```
10  REM  ******************************
20  REM  EXAMPLE PROGRAM FOR THE
30  REM  COMPUTER PROGRAMMING PROJECT
40  REM  ******************************
43  REM
44  REM  *************
45  REM  BY JOHN SMITH
46  REM  ACME JR. HIGH
47  REM  *************
50  HOME
60  PRINT "THIS PROGRAM WILL ESTIMATE THE"
70  PRINT "THE COST OF A PROJECT BASED ON THE"
80  PRINT "LINEAR FEET OF MATERIAL NEEDED"
90  PRINT "AND THE COST OF THE MATERIAL"
100 PRINT "PER LINEAR FOOT."
110 PRINT : PRINT
120 PRINT "HOW MANY LINEAR FEET OF MATERIAL"
130 PRINT "WILL THE PROJECT REQUIRE?"
140 INPUT LF
145 REM  LF = LINEAR FEET
150 PRINT : PRINT
160 PRINT "WHAT IS THE COST OF THE MATERIAL"
170 PRINT "PER LINEAR FOOT?"
180 INPUT C
185 REM C = COST PER FOOT
190 PRINT : PRINT
195 REM  FIGURING COST
200 PC = LF * C
205 REM  PC = PROJECT COST
210 PRINT "YOUR PROJECT WILL COST ABOUT $";PC
220 END
```

WRITING A PROGRAM IN BASIC

Introduction:

Now that you have planned your program, you need to ask yourself this question: How do I tell the computer what I want it to do? Remember, you have to talk to the computer in a language it can understand. The computer can not understand English. Therefore, programs written in English need to be converted to programs written in a computer language.

There are three basic considerations for writing a program. The first consideration is called documentation. Documentation provides information about the program like what does it do and who wrote it. In addition, documentation is used to label parts of the program and describe how they work. Computer programs can be hundreds and even thousands of pages long. When trouble-shooting a long program, it is important to be able to locate the trouble spot and make corrections. In Basic, REM statements are used to document a program.

It is not enough that the program works, it has to look good. The process of making a program's output look good on the screen is called formatting. Formatting is our second basic consideration when writing a program. Commands like VTAB, HTAB, and PRINT can be used to arrange information on the screen so it is easy to read and looks good.

Lastly, the program needs to be easy to use. Programs that are easy to use are called "user friendly." When a program is user friendly, the user does not have to guess how to use it. The program introduces itself, it is easy to read, and easy to follow. A good way to make sure your program is user friendly is to have several friends try it. Watch what they do. Do not provide any help. If they can use the program without any problems, it is probably user friendly enough for this project.

Examine the following example program. Notice how the documentation and formatting were included in the program.

```
 10  REM  ******************************
 20  REM  EXAMPLE PROGRAM FOR THE
 30  REM  COMPUTER PROGRAMMING PROJECT
 40  REM  ******************************
 43  REM
 44  REM  *************
 45  REM  BY JOHN SMITH
 46  REM  ACME JR. HIGH
 47  REM  *************
 50  HOME
 60  PRINT  "THIS PROGRAM WILL ESTIMATE THE"
 70  PRINT  "COST OF A PROJECT BASED ON THE"
 80  PRINT  "LINEAR FEET OF MATERIAL NEEDED"
 90  PRINT  "AND THE COST OF THE MATERIAL"
100 PRINT  "PER LINEAR FOOT."
110 PRINT  :  PRINT
120 PRINT  "HOW MANY LINEAR FEET OF MATERIAL"
130 PRINT  "WILL THE PROJECT REQUIRE?"
140 INPUT  LF
145 REM  LF = LINEAR FEET
150 PRINT  :  PRINT
160 PRINT  "WHAT IS THE COST OF THE MATERIAL"
170 PRINT  "PER LINEAR FOOT?"
180 INPUT  C
185 REM  C = COST PER FOOT
190 PRINT  :  PRINT
195 REM  FIGURING COSTS
200 PC = LF * C
205 REM  PC = PROJECT COST
210 PRINT  "YOUR PROJECT WILL COST ABOUT $":PC
220 END
```

How the Program Works:

Lines 10 through 47 provide documentation regarding the purpose of the program and the author. In line 50, the command HOME tells the computer to clear the screen.

Using PRINT statements, lines 60 through 100 introduce the user to the program. The introduction tells the user what the program can do. Line 110 uses two PRINT commands to leave a space on the screen (formatting).

Lines 120 and 130 ask the user to enter the amount of materials needed for a project. The INPUT statement in line 140 allows the user to enter the number of linear feet. Notice, the meaning of LF is explained with a REM statement in line 145. Line 150 formats the screen with two more spaces. The user is asked the cost of the material per foot in lines 160 and 170. A REM statement tells you what "C" stands for (cost) in line 185. Once again, two PRINT statements are used to format the screen.

Line 195 labels the section of the program that figures the cost of the project. Line 200 tells the computer that the cost of the project equals the number of linear feet multiplied by the cost of the materials per foot. Line 205 explains the meaning of "PC." The PRINT statement in line 210 tells the user the cost of the project. Line 220 ends the program.

Writing a Program in BASIC

Directions:

Using your program planning activity as a guide, write a program using the Basic computer language. Follow the steps listed below when writing your program.

1. Convert each statement written in English to commands in the Basic computer language.

2. Document your program using REM statements. Include a title for the program and the name(s) of the author(s). You may want to label special sections of the program.

3. Have your teacher approve your program.

4. Enter your program in the computer and save it on a diskette.

5. Run the program. Identify trouble spots and make corrections. After the corrections have been made, save the program again using the same file name.

6. Now that the program works, it is time to make it look good. Add VTAB, HTAB and/or PRINT statements to make your program's output look nice.

7. When you are sure your program is done, save it one last time. Turn your diskette into your teacher for evaluation.

UNIT: Exploring Computer Technology

LESSON 6: Computer-Aided Design/Drafting

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -the applications for CAD -the basic parts of a CAD system	A. CAD 1. CAD is using computer technology to help design products, design production systems and make drawings. 2. Parts of a CAD system a. computer hardware b. CAD software c. user (designer or drafting technician) 3. CAD applications a. mathematical modeling b. engineering analysis c. drafting 4. Advantages of CAD a. faster b. easier to make changes c. easier to store and retrieve information d. more accurate than conventional methods e. more powerful information process ability	A. Teacher Guided Discussion 1. Discuss the role of computers in processing the information required to design a new product. 2. List the basic parts of a CAD system. 3. Explain the three basic applications for CAD technology. 4. List the advantages CAD has over conventional design and drafting methods.	TA #6-1: Computer-Aided Design/Drafting

B. During a lab activity following a demonstration, students will be able to use available CAD, or CAD-like software to create, store and print a one view drawing of a given object.	B. Using CAD software 1. design problem identification and analysis. 2. booting the software 3. following the menus 4. making a drawing a. moving the cursor b. plotting points c. drawing lines d. drawing circles e. erasing f. documentation 5. saving a drawing 6. printing a drawing	B. Learning Activity 1. Demonstrate how to use the software and hardware available for computer-aided drafting. 2. Have students choose a design problem and make a one view drawing of their design solution. 3. Have students share their computer application experience with their peers. 4. Collect, evaluate and display their computer-aided drafting assignment.	HO #6-1: Computer-Aided Design/Drafting

COMPUTER-AIDED DESIGN/DRAFTING

Introduction:

Due to the variety of CAD hardware and software being used in industrial technology programs, it is impossible to design one generic learning activity that will work in every context. Therefore, the following represents suggestions for designing a CAD learning experience for your students.

CAD Software:

There are a lot of CAD programs available for microcomputers. Most of the programs represent computer-aided drafting more than computer-aided design. However, even the simplest drawing program can reinforce many of the important CAD concepts. When using or selecting CAD software, it is important to consider user-friendliness. You want CAD to be a positive experience for your students. Your software should be easy to use right from the start. You should not have to spend a lot of time teaching students how to use the program. After all, many of your students may never use CAD again and rarely can schools afford the CAD programs used in industry.

Software used at the exploration level should be low cost and have high impact. That is to say, it should be an affordable program that enables all your students to have a CAD experience. A common mistake is to purchase a fancy program that only enables a few of your students to experience CAD. Alot of CAD programs on the market are under $100. You should not expect these programs to prepare CAD technicians, but they are very appropriate for the exploration level.

Lastly, consider the program's hardware requirements. Most CAD programs require special input devices (a joy stick, digitizer tablet, or mouse) and/or output devices (interface cards or plotters). Some programs require extra memory or make it difficult to use the computer for other applications after it has been set up for CAD. Special hardware requirements can add to the cost of implementing CAD and limit your ability to use the existing computers in the school. If you have limited funds, try to use a program that runs on 64K of memory, can accept input through the keyboard, and will dump to most dot-matrix printers.

Consider the following software packages for implementing CAD in your curriculum.

TITLE	PUBLISHER
CADD Draw	Kitchen Sink Software
CADRIC	Alpha-Omega Computer System
Car Builder	Weekly Reader Family Software
Glide Path	Human Relations Media
Quick Draft	Interactive Microware, Inc.
Hi-Res Electrical Design	Avant-Garde Creations
Hi-Res Architectural Design	Avant-Garde Creations
Architectural Design, Professional Version	Avant-Garde Creations
Robo Graphics CAD-1 System	Chessell-Robocom Corp.
Design-A-Room II	Computer Aided Instruction Sys.
Design-A-Circuit II	Computer Aided Instruction Sys.
Perspectives	Pioneer Software Inc.
Gibson Light Pen	Koala Technologies Corp.

Designing a Learning Activity:

Before implementing CAD, you will need to learn how to use the software, identify your limitations, and design a project that students can do successfully. If you want to emphasize design, you may want your students to design a product of the future. For example, using CAD technology, students could design either a car, airplane, house, space station, or space shuttle for the year 2000. Such a project will encourage original thinking and still develop a basic command of the computer software and hardware. In addition, every student can be successful because there isn't a right or wrong answer to the design problem. The following are a few more suggestions for design projects:

* Design a floor plan for a hunting cottage. Include two exits, a sleeping area, kitchen, and a full bathroom.
* Design a two-way (woofer and tweeter) book shelf speaker.
* Design a custom model rocket. Include fin, nose cone, and decorative designs.
* Design a model car that is powered by a CO2 cartridge.
* Make your design as aerodynamic as possible.
* Design a device that hangs inside a locker and holds pens and pencils.
* Design a desk top container that will hold computer disks. Your design needs to use a material other than metal.
* Design a device that would display business cards on a desk.

If you want to emphasize drafting, consider assigning a project that requires only one view or can be drawn from a mock-up. Using the computer as a drafting tool will be new.

The assignment may need to be as simple as their first drafting assignment if they are going to be successful.

Teacher Guided Discussion:

Describe how the information required to manufacture a product was pro-cessed before the computer became an integral part of the design process. Discuss how the computer has become one of the most important tools for solving design problems in industry. Provide students with examples of how computers are used as a designing tool in manufacturing, construction, communication, transportation and energy utilization.

Explain how CAD is using computer technology to help product designers create new products, plan production systems and make working drawings. List on the chalk board the basic parts of a CAD system (computer hardware, CAD software, and user). List the basic applications for CAD technology. Explain how CAD converts design ideas into mathematical models that can be modified, tested, and used to program production machines. Explain how the mathematical models can be used for engineering analysis. Lastly, explain and discuss the value of the CAD system as a drafting tool. Include in your discussion the advantages of using CAD over traditional drafting techniques. Make sure your students understand that the real power of CAD is not in making drawings. The power of CAD lies in the fact that it enables the designer to create mathematical models that can be stored in a data base and used in a variety of applications that minimize the need for drawings. Summarize by explaining how using CAD in industry can improve accuracy, efficiency, and productivity.

Implementing the Learning Activity:

Demonstrate how to use the software and hardware available for design applications. Your demonstration should include things like problem analysis, booting the software, following the menus, making a drawing, saving a drawing, and printing a drawing. During your demonstration, allow students to try moving the cursor, plotting points, drawing lines, drawing circles, erasing, and documenting (lettering). Lastly, show students how to evaluate their designs.

Provide your students with a list of design projects that can be accomplished using the hardware and software available. Allow students to choose the design problem

they want to address. Have students begin designing. Provide individual instruction as needed. At the end of the lesson, have students share with their classmates their experiences using the computer as a designing tool. Collect, evaluate and display their computer-aided drafting assignment.

COMPUTER-AIDED DESIGN/DRAFTING

Every product we buy requires information processing. Until recently, most information processing was done manually. Before a product could be produced, a lot of drawings and calculations had to be made. Today, computers are often used to help design products. Instead of using a pencil and paper, the designer uses a computer to record and process their ideas. Designing a product with the help of a computer is called "computer-aided design" or CAD. A CAD system has three basic parts: hardware, software, and users.

A CAD system has three basic applications. The first application is called mathematical modeling. Let's say a designer is developing a new airplane. The designer enters design ideas by drawing a picture on the computer. Inside the computer the information is converted into a set of numbers that represent the airplane. This group of numbers is a mathematical model of the airplane. The designer can see the mathematical model on the monitor in the form of a picture. Since the airplane design is really a set of numbers, it can be changed. Using computer commands, the designer can tell the CAD system to rotate the airplane. If the designer needs to see a small part of the airplane, another command can be used to "zoom" in on a small part of the design. Using other commands the designer can cut away sections and look at a cross section of the airplane. The mathematical model of the airplane can be stored on disk, used to program machines, change inventory records, and much more.

The second application for a CAD system is called engineering analysis. Because the design is basically a group of numbers, the computer can help perform calculations. Using a few commands, for example, the designer can determine things like the amount of materials needed to make the product, the cost of the product, and the weight of the product. In addition, the designer can use the mathematical model to simulate how the design will perform under real conditions. For example, a real payload can be put into a truck design. Using the simulated load, weakness in the truck's frame can be identified right on the screen.

Lastly, a CAD system can be used to produce drawings of the product. Unlike conventional drafting, design changes can be made quickly. Using conventional drafting methods, design changes often mean drawing a new set of plans. With a CAD system, the designer simply enters the needed modification in one view of the drawing and the computer automatically makes the required changes in other views. Once all the changes have been made, the computer can make a new set of drawings in minutes.

By using CAD, automobile manufacturers can redesign an automobile in almost half the time it took with conventional methods. When designers use a CAD system, they can spend more time creating and solving problems. The boring and time consuming parts of drafting are performed by the computer. The accuracy, flexibility, and efficiency make computer-aided design and drafting one of the most valuable tools in industry.

UNIT: Exploring Computer Technology

LESSON 7: Computer-Aided Manufacturing

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -the relationship between CAD and CAM. -the three basic applications for CAM. -the advantages of CAM over conventional production methods.	A. CAM 1. CAM is using computer technology to help plan, operate, and manage production systems. 2. Parts of a CAM system a. hardware (computers and machines) b. software (the CAM program) c. user 3. CAM applications a. numerical control b. process planning c. factory management 4. Advantages of CAM a. faster b. more accurate c. more efficient	A. Teacher Guided Discussion 1. Discuss the role of computers in processing the information required to manufacture a new product. 2. List the basic parts of a CAM system. 3. Explain the three basic applications for CAM technology.	TA #7-1: Computer-Aided Manufacturing

B. During a lab activity following a demonstration, students will be able to use available CAM, or CAM-like software to accurately program a simulated production sequence.	B. Using CAM, or CAM-like Software 1. problem analysis 2. booting the software 3. following the menus 4. programming a production sequence 5. executing the program 6. evaluating the product	B. Learning Activity 1. Demonstrate how to use the software and hardware available for computer-aided manufacturing. 2. Have students perform a CAM simulation. 3. Have students share their computer application experience with their peers. 4. Collect, evaluate and display their computer-aided manufacturing assignment if applicable.	HO #7-1: Computer-Aided Manufacturing

COMPUTER-AIDED MANUFACTURING

Introduction:

Due to the variety of CAM hardware and software available for use in industrial technology programs, it is impossible to design one generic learning activity that will work in every context. Therefore, the following will describe three possible options for providing students with a CAM learning experience.

Using Software to Simulate CAM:

Few schools can afford the equipment necessary to teach CAM. Fortunately, there is software on the market that reinforces many important CAM concepts. "The Factory" is a software package published by Sunburst Communication that simulates a manufacturing sequence. The concept of simulation is in itself an important CAM concept. In industry, CAM procedures are often simulated on the screen before they are executed. The simulation allows the user to evaluate, correct, or refine a CAM procedure without actually making a product.

The program requires students to analyze a randomly displayed product (let's say it is a CAD generated model), program up to eight symbolic machines, and simulate producing the product. If the simulation is programmed correctly, the product produced on the screen will match the one displayed. If the programming is incorrect, the products will not match, the program will announce a "flaw" and the student will have an opportunity to try again. A hard copy printout of a production simulation can be made. In addition to simulating CAM, the program also develops sophisticated problem solving skills. Simulating CAM with "The Factory" will cost about $60.

Using Fishertechnik to Simulate CAM:

Fishertechnik offers several products for table top manufacturing. The least expensive option is a computer-controlled model kit that simulates several examples of automation. The kit uses modular parts to construct 10 working models which interface with a computer. The possible CAM related models include a sorting system, a machine tool, and a material lift model. Students could assemble a model in several class periods. If time is limited, you could assemble a model for the students to operate or for a CAM demonstration. Providing a CAM learning experience with one Fishertechnik work station will cost about $260. (not including the computer). More sophis-

ticated and expensive options are available. Fishertechnik products are available through TransTech Systems, Div. of Creative Learning Systems, Inc., 9889-E Hibert Street, San Diego, CA 92131.

Using a CAM Trainer:

Using a CAM or CNC trainer is the most expensive option. In addition, it may be too complicated for a short exploration experience. Therefore, if you choose to go this route, you may need to simplify its operation by providing the program or by limiting its use to one or two machining operations. Another way to use a trainer is to facilitate a teacher demonstration that allows students to get actively involved in the trainer's operation. Using a CAM trainer can be very expensive. They typically range between $2,500 and $5,000. Following are two CAM and CNC manufacturers you may want to investigate.

Light Machines Corporation
669 East Industrial Drive
Manchester, NH 03103
(603)625-8600

Paxton/Patterson
5719 West 65th St.
Chicago, IL 60638
(312)594-7270

Teacher Guided Discussion:

Describe how the information required to manufacture a product was processed before computers became an integral part of the production process. Discuss how the computer has become one of the most important production tools in industry.

Define CAM as using computer technology to help plan, operate, and manage production systems. List on the chalk board the basic parts of a CAM system (computer hardware, automated machines, CAM software, and user). List the basic applications for CAM technology (numerical control, process planning, and factor management). Explain the relationship between CAD and CAM. Describe how the mathematical model created through CAD is used to program production machines in CAM. Include in your discussion the advantages of CAM over traditional production techniques. Make sure your students understand that automation typically results in greater efficiency and improves productivity.

Consider using one of the many video tapes available on CAM technology. You could visit a local industry which uses automation in the production of a product. Another means of presenting content is to have a guest speaker talk to your class about CAM, CNC, or automation.

Implementing the Learning Activity:

Demonstrate how to use the software and hardware available for simulating CAM. Your demonstration should include things like problem analysis, setting up hardware, booting the software, following the menus, programming a production sequence, executing the program, and evaluating the results. During your demonstration, provide students with opportunities to participate.

Provide your students with a production problem if applicable. Students can simulate CAM technology using the hardware and software available. Provide individual instruction as needed. At the end of the lesson, have students share their experiences using the computer as a production tool. Collect, evaluate and display their computer-aided manufacturing projects if applicable.

COMPUTER-AIDED MANUFACTURING

Producing a product requires a lot of information processing. Before automation (control through automatic devices instead of human beings) information had to be processed manually. People had to read plans, plan production systems, and operate production machines. Machine operators often had to perform the same task over and over again. For the operator, the process was slow and boring. During a manufacturing process, accuracy is very important. Unfortunately, when machine operators got tired of the repetition, mistakes were often made. Mistakes waste time, money, and materials. It is difficult for human beings to repeat a task so many times and do it accurately every time. Automation is now used to perform many of the repetitious tasks in manufacturing.

"Computer-aided manufacturing" (CAM) is one form of using computers to automate a production system. CAM is an extension of CAD (computer-aided design). During the product design process, CAD converts design ideas into groups of numbers. During the production process, CAM uses the groups of numbers from CAD to operate the machines that make the product.

CAM systems have three basic applications. The first application is called "direct numerical control" or DNC. In the CAM system, the production machines are connected to a computer. After the designer finishes designing a part, he or she can create a program that will manufacture the part. The program contains information about the cutting tool to be used, how fast the cutting tool should turn, how fast the materials should be fed into the cutting tool, and how to machine the part. The program is stored in the computer. When it is time to make the part, the information stored in the computer is fed into the machine and the part is made automatically.

The second application for a CAM system is called process planning. Process planning determines the best way to make the product. Process planning involves processing information into a series of steps. Process planning occurs between product design and product manufacturing. The information that has to be processed includes things like:

* How many products will be made?
* What material will be used to make the product?
* What kinds of machines are needed to make the product?
* What order do the machines need to be in to make the product?
* How much will it cost to make the product?

CAM uses computer technology to process this kind of information so the product can be manufactured.

The last application for CAM is factory management. Computers are used to process information during the production process. Scheduling, inventory control, quality control, and material handling are just a few of the things that have to be managed during production.

CAM is helping to automate factories so they can be more productive. Unlike people, automated machines do not get tired and bored. Repetition with accuracy is one of the things automated machines do best. However, automated machines cannot think; this is one of the things that people do best. Automation frees people from doing boring tasks and allows them more time to be creative and to solve problems.

UNIT: Exploring Computer Technology

LESSON 8: Robotics

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -the definition for an industrial robot. -the basic parts of an industrial robot. -the three d's for robotic applications. -the three basic industrial applications for robots.	A. Robotics 1. "An industrial robot is a programmable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks." (Robotics Industries Assoc., 1985) 2. Basic parts of an industrial robot a. manipulator arm b. controller c. power supply (electric, hydraulic, or pneumatic) 3. The three d's of robotic applications a. dull b. dirty c. dangerous	A. Teacher Guided Discussion 1. Discuss the role of robotics in manufacturing. 2. List the basic parts of an industrial robot. 3. Explain the three d's for robotic applications in industry. 4. List and discuss the four basic industrial applications for robotics.	TA #8-1: Robotics

4. Material handling
   a. loading and unloading machines
   b. lifting between work stations
   c. packaging
   d. palletizing (heavy-duty)
5. Tool operations
   a. welding
   b. drilling
   c. cutting
   d. painting
   e. deburring
   f. testing and inspection
6. Assembly

B. During a lab activity following a demonstration, students will be able to use available robotics, or robotic-like, software and hardware to teach a robot to perform a given task.	B. Using Robotics 1. interfacing hardware (computer and robotics) 2. booting software 3. problem analysis	B. Learning Activity 1. Demonstrate how to use the software and hardware available for robotics. 2. Provide students with a problem that can be solved using the robotics available. 3. Have students teach the robot and execute the solution to the problem. 4. Have students demonstrate the robotic solution to the problem posed for evaluation.	HO #8-1: Robotics

ROBOTICS

Introduction:

Robotics can be experienced through a variety of mediums. The hardware and software possibilities include simulation programs, model industrial robots, and table top industrial robots. No one single activity could accomodate all the robotics teaching tools available. The following will describe several options for implementing robotics into the curriculum.

Using Software to Simulate Robotics:

Few schools can afford the sophisticated robotics available on the market. Fortunately, there is a software package on the market that simulates an industrial robot performing industrial tasks. Using this program, students experience teaching (programming) a simulated robot for palletizing, vision inspection, and spot welding. The program is called Robcat, and costs about $50, and is available through the following vendors:

Hearlihy and Co.
714 W. Columbia Street
Springfield, Ohio 45501
(513)324-5721

Career Aids, Inc.
20417 Nordhoff Street, Dept. S4
Chatsworth, CA 91311
(818)341-8200

Like CAM, the concept of simulation is an important robotic concept. The programming for an industrial robot is often tested in a computer simulation before it is actually used in a production system.

Using a Memocon Crawler:

A Memocon Crawler is a small turtle-like robot that can be programmed from a teach pentant. The robot comes in the form of a kit. However, the kit may be too difficult and time consuming for students to assemble during an exploration experience. In addition, once the kit is assembled, you would not want to take it apart and use for another class. Therefore, you may want to assemble the kit and have students program it to solve a material handling problem. The crawler is analogous to the Automated Guided Vehicle used to move materials in flexible manufacturing. Templates representing workcells could be placed on the floor of the lab. Students could be asked to program the crawler to move from one work cell to another according to a

production sequence you provide. The Memocon Crawler costs about $90 and is available through:

TransTech Systems
Div. of Creative Learning Systems, Inc.
9889-E Hibert Street
San Diego, CA 92131

Hearlihy and Co.
714 W. Columbia Street
Springfield, Ohio 45501
(513)324-5721

Career Aids, Inc.
20417 Nordhoff Street, Dept. S4
Chatsworth, CA 91311
(818)341-8200

Using Fishertechnik for Teaching Robotics:

Fishertechnik offers several products for table top manufacturing that includes robotics. The least expensive option is a computer-controlled model kit that simulates several examples of automation. The kit uses modular parts to construct 10 working models which are interfaced with a computer. Two of the automated projects are industrial robots, one of which is a teachable robot. These model robots perform pick and place operations. A team of students would need several class periods to assemble a model robot. If making the robot is not an important objective, you may want to assemble the robot yourself and put emphasis on having students teach it to solve a material handling problem. Again, one Fishertechnik work station will cost about $260 (not including the computer). More sophisticated and expensive options are available. Fisher-technik products are available through TransTech Systems.

Using a Table Top Robot:

Using a table top robot is the most expensive option. At the exploration level, students could learn to teach the robot to perform pick and place operations in a very short period of time. Table top robots for education cost about $2,500 and go up from there. Table top robots are available through:

Feedback, Inc.
620 Springfield Ave.
Berkely Heights, NJ 07922

Microbot, Inc.
453H Ravendale Dr.
Mountain View, CA 94043

Rino Robots, Inc.
2505 South Neil
Champaign, IL 61820

Marcraft International Corp.
100 N. Morain Street
Kennewick, Washington 99336

Teacher Guided Discussion:

Introduce students to the difference between science fiction robots and the robots used in industry. Discuss how robotics has become an important production and material handling tool. Explain why robots are considered part of CAM.

Define what an industrial robot is and list on the chalk board the three basic parts of an industrial robot. Explain the function of each basic part.

Discuss the three D's for robot applications. Include in your discussion the need for robots to perform industrial tasks that are too monotonous, difficult, or dangerous for people to perform. List the basic industrial applications for industrial robots in a production context. Provide examples for each application.

Explain why robots are an extension of humankind like other tools. Discuss how using robotic technology typically results in greater efficiency and improved productivity.

Consider using one of the many robotics video tapes available to present content. Another option could be to visit a local industry using robotics or have a guest speaker talk to your class about robotics.

Implementing the Learning Activity:

Demonstrate how to use the software and hardware available for robotics. Your demonstration should include things like setting up hardware, booting the software, problem analysis, teaching (programming) the robot, executing the program, and evaluating the results. Provide students with an opportunity to participate during the demonstration.

If applicable, provide your students with a production problem that can be solved with the robot. Have students teach the robot to perform a task addressing the problem posed. Provide individual instruction as needed. Have students demonstrate their solution to the problem for evaluation. You may want the students to demonstrate how the problem was solved for their peers.

ROBOTICS

The robots you have seen in science fiction movies really have very little in common with industrial robots. "An industrial robot is a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmed motions for the performance of a variety of tasks" (Robotics Industries Assoc., 1985). More simply put, an industrial robot is a machine that can be taught to perform an industrial task. Since robots play an important role in production process, they are considered part of the CAM (computer-aided manufacturing) system.

Industrial robots have three basic parts; a manipulator arm, a controller, and a power supply. The manipulator arm is the part that actually does the work. The manipulator arm, like a human arm, includes joints and an "end effector." The end effector acts like a human hand. It can have two or three gripper-like fingers that can pick up parts or a chuck (holder) for a specific tool.

The controller, the robot's brain, is basically a computer. Robots are not programmed like most computers. Programming a robot is called "teaching." Most robots have a controller that includes a teach pendant. The teach pendant is a hand held box with buttons on it. Each button represents a function the robot can perform. To teach a robot to perform a given task, a technician uses the teach pendant to have the robot act out the task. While the robot is acting out the task, each step it takes is being stored in the memory of the controller. Once the robot has been taught a task, it can perform the task over and over again automatically.

The power supply provides the power for the manipulator arm. It can either be electric, hydraulic, or pneumatic. The power supply acts like the robot's heart and muscles. It provides the energy for pushing, pulling, turning, and lifting.

Industrial robots are an extension of a human being in much the same way as a hammer is; they are both tools that help us be more productive. A hammer makes driving a lot of nails in a short period of time possible. Robots make welding a lot of cars on an assembly line possible. Neither a hammer or a robot will work without people. Without the craftsman, a hammer uses up space and collects dust. Without a technician, an industrial robot is just as useless. Robots, like computers, are dumb. They have to be taught every step in order to perform a task. No one should have

to drive nails without a hammer. It would be very difficult and dangerous. Basically, robots do jobs people should not have to do. They perform tasks that are typically dull, dirty, and/or dangerous. For example, welding and painting are jobs often performed by robots on automobile assembly lines. In both cases, the job involves repetitive tasks, requires protective clothing, and produces fumes that are hazardous to people. It is appropriate for a robot to do these jobs.

Industrial robots are used for three basic types of jobs. The first one is materials handling. Robots can be used to load and unload machines automatically. They can also be used to move materials from one work station to another. At the end of an assembly line, robots can be used to put finished products in packages. Lastly, robots can be used to put large and/or heavy products on pallets (a movable platform for a fork lift).

Tool operations are the second basic type of task performed by industrial robots. These tool operations include things like welding, drilling, cutting, painting, deburring, testing and inspection.

The last basic type of task performed by industrial robots is assembly. Most assembly tasks are too complicated for robots to perform. However, simple and repetitive assembly jobs can be done by a robot. One common application for robotics in assembly is inserting electronic components into printed circuit boards.

Industrial robots typically increase production capability, improve product quality and lower production costs. They do not get sick, they do not get bored, and they can work 24 hours a day without a break. Industrial robots allow people to spend more time doing what they do best, thinking.

UNIT: Exploring Computer Technology

LESSON 9: Electronic Publishing

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -a definition for electronic publishing -the basic processes used in electronic publishing -the basic applications for electronic publishing -the advantages of electronic publishing	A. Electronic Publishing 1. Electronic publishing is: a. the applications of computers to do traditional print publishing. b. the storage and retrieval of information through electronic communication media. 2. electronic publishing processes a. gathering information b. entering text c. entering illustrations and photographs d. composition e. editing f. typesetting h. storage i. retrieval j. distribution and production 3. applications a. newspaper publishing b. magazine publishing c. book publishing d. desktop publishing e. business form manufacturing f. information services	A. Teacher Guided Discussion 1. Discuss the role of computers in the graphic arts industry. 2. Define the concept of electronic publishing. 3. Discuss the processes used to create a graphic product using computer technology. 4. List and discuss the applications for electronic publishing technology. 5. Explain the advantages of electronic publishing.	TA #9-1: Electronic Publishing

B. During a lab activity following a demonstration, students will be able to use the available electronic publishing (simulation) software to create a graphic product that communicates a message.	B. Creating Graphic Products 1. gathering information 2. booting software 3. entering text 4. creating graphics 5. composing 6. printing final product 7. distributing final product	B. Learning Activity 1. Demonstrate how to use the software and hardware available for creating graphic products. 2. Provide students with a problem that requires a graphic arts solution. 3. Have students use the software and hardware available to create a graphic product that addresses the assigned problem. 4. Collect, evaluate, and display the graphic products.	HO #9-1: Electronic Publishing

ELECTRONIC PUBLISHING

Introduction:

Even the cheapest electronic or desk top publishing systems are out of reach for many schools. Fortunately, there are a variety of software packages on the market that can simulate electronic publishing using a microcomputer. The following suggestions focus on two possible learning activities, making a poster and creating a newspaper.

Making a Poster Electronically:

There are a variety of programs available that will enable your students to produce a poster electronically. Typically, they are inexpensive, easy to learn, easy to use and do not require a lot of time. An activity of this kind can reinforce many of the concepts in electronic publishing. Listed below are a few of the software packages you may want to consider.

Title	Publisher
Mouse Paint	Apple Computer, Inc.
Print Shop	Broderbund
Dazzle Draw	Broderbund
Fontrix	Data Transforms, Inc.
The Professional	Data Transforms, Inc.
Sign Maker	Sunburst Communications

Once your students have learned how to use a software package, they could use it to address a specific communication problem. Listed below are a few example problems you may want to consider for your student's electronic publishing experience.

* Identify a potential safety problem in your laboratory.
* Using the computer, make a poster that clearly communicates the correct safety precautions.
* Using the computer, make a poster announcing an AIASA or other school event. Include information like the name, time, date, and place of the event.
* Using the computer, make a poster advertising a product your class manufactured. Include the name of the product, the name of the student company, the price of the product, and where the product can be purchased.

Creating a Newspaper Electronically:

Electronic publishing is commonly used to produce newspapers for national distribution. Using the software package titled "Newsroom," you can simulate many of the techniques used to publish some of the larger newspapers. The package is published by Springboard and costs about $50. Newsroom includes several departments, photo lab, banner, layout, wire service, and press. You may want to divide your class into small groups, assign each a specific department and have them make a newspaper or newsletter. The publication could focus on the class, an AIASA club, or a student enterprise. When the newspaper is ready, make copies on the duplication system commonly used in your school. An example is to print it on computer paper and duplicate it using electrostatic printing (e.g., xerox). The potential of the simulation can be experienced by electronically transmitting your newspaper to another school using the "wire service" feature and a modem. The other school, or location, would need to have a computer, newsroom, and a modem in order to receive your newspaper.

Teacher Guided Discussion:

Show students one of the national newspapers or magazines (e.g., USA Today, U.S. News and World Report or Time). Explain how information needs to be gathered, organized, printed and distributed nationwide on a weekly and daily basis. Ask students how they think the publication got to their town (by truck, plane, mail, etc.). Discuss how difficult it would be to write and print a newspaper in one part of the country and make it available to everyone throughout the country overnight. Explain how computers and telecommunications make moving information overnight possible. Describe electronic publishing as the applications of computers to traditional print publishing. Include in your discussion how electronic publishing involves the storage and retrieval of information through electronic communication media.

List and discuss the basic processes used in publishing materials electronically. Describe the role of computers in each process.

List and discuss the applications for electronic publishing technology. Include examples like newspaper publishing, magazine publishing, book publishing, desktop publishing, business form manufacturing, and information services. Lastly, discuss the advantages of electronic publishing over traditional publishing techniques.

Implementing the Learning Activity:

Demonstrate how to use the software and hardware available for electronic publishing. Your demonstration should include things like problem analysis, booting the software, following menus, choosing fonts, entering text, adding (or creating) graphics, layout, and printing. Allow students to participate during the demonstration.

If applicable, provide your students with a communication problem that can be solved with the available software. Have students produce a graphic product that addresses the problem posed. Provide individual instruction as needed. At the end of the period, collect, evaluate and display the electronically produced graphic products.

ELECTRONIC PUBLISHING

Publishing newspapers, magazines, books and documents requires a lot of information processing. Before computers, this information had to be processed manually. Writers created their text on typewriters. An editor had to read the typewritten copy and pencil in corrections and refinements. The edited copy was sent to a typesetter who entered the information into a typesetter. The typesetter produced copy that could be photographed. Layout people would have to cut and paste copy, headlines, and photographs together by hand. The paste-up copy was often photographed and the negatives were used to make printing plates. The plates containing the information were mounted on printing presses and the final product was produced. Distributing the final product was often limited to the U.S. Postal Service or private distribution services. The use of computers in the graphic arts industry have made these steps easier and faster. In addition, computers have introduced new ways of moving information through the printed word.

The application of computers in publishing is called "electronic publishing." Electronic publishing is basically storing, accessing, and processing information with electronic communication technology. Information is stored in a central computer and delivered to the user through a telecommunication system.

Using electronic publishing, you can access information stored in a central computer source called a data base. A data base is like an electronic library you can visit through your phone line and computer. Data bases typically contain up-to-date information on topics like medicine, industry, agriculture, science, and education. In order to gather specific information about a topic, a writer performs what is called "computer searches." A computer search is like looking through a card catalog, finding the book you need, and being able to read it without leaving your computer. Best of all, a computer search only takes a fraction of the time it takes to find information manually.

Once information has been gathered electronically, it can be combined with new information electronically through word processing. Word processing enables a computer to act like a typewriter. However, a word processor can do a lot more than a typewriter. It allows the writer to enter text, erase mistakes, move sentences, move paragraphs, check spelling, and much more. In addition, the information can be stored electronically. When the information needs editing, it can be retrieved from storage and all the modifications can be made electronically.

With some electronic publishing systems, illustrations and pictures can be converted into an electronic form. In this new form, they can be combined with the text.

During composition (putting it all together in an organized form) both pictures and text can be moved around and changed so each page looks nice. During a final editing stage, the computer is used to correct errors, delete copy, insert copy, and organize the materials. After final editing, the information is stored electronically again.

Preparing copy for reproduction (printing) is called typesetting. In electronic publishing, the typesetting is also performed electronically. Information is accessed from storage and typesetting codes are added. These typesetting codes tell the typesetter things like what type size and style to use. After typesetting, the information can be stored, used to produce the finished product locally, or mailed electronically to distant locations. Mailing the information means sending it through a telephone line, microwave link, or satellite to a new location. At the new location, the information can be printed or displayed for the consumer.

Large scale electronic publishing is being used by large newspapers and news magazines. With electronic publishing technology, the publishers can send their latest edition to various parts of the United States electronically. The newspaper or magazine may be designed in one location, but it is printed and distributed in several locations. Large business form manufacturers and book publishers also use forms of electronic publishing.

Electronic publishing technology in its smallest form is called "desktop publishing." With desktop publishing, personal computers, printers, and special software are used to produce high-quality professional looking documents. With desktop publishing, a company only needs to produce as much printed material as they need. Since the information is stored electronically, if they need more copies, they can access the stored information and print as many as they need. Using an outside company for printing documents is expensive and time consuming.

The use of computers in the graphic arts industry means we have access to more information than ever. In addition, the cost of information has been reduced.

UNIT: Exploring Computer Technology

LESSON 10: Management Information Systems

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a discussion, students will be able to identify: -the purpose for management information systems. -the basic types of software used in management information systems. -the technologies used in management information systems	A. Management Information Systems 1. MIS use computer technology to process, store, and distribute the information needed to maintain an enterprise. 2. applications for MIS a. communications b. record keeping c. financial affairs 3. basic types of software in MIS a. word processing programs b. data base programs c. spread sheet programs d. business graphics programs 4. MIS technologies a. word processing b. telecommunication systems c. electronic mail d. electronic funds transfer	A. Teacher Guided Discussion 1. Discuss the role of computer in managing an enterprise. 2. Define the concept of management information systems. 3. Discuss the basic applications for MIS. 4. Discuss the basic types of software used in MIS. 5. Discuss the asic types of technologies used in MIS.	TA #10-1: Management Information Systems

B. During a lab activity following a demonstration, students will be able to use the available applications software to process, store, or distribute information.	B. Using MIS 1. gathering information 2. processing information 3. storing information 4. distributing information	B. Learning Activity 1. Demonstrate how to use the available word processing, data base, spread sheet, and business graphics software. 2. Provide students with a MIS project. 3. Have students use the software and hardware available to complete the MIS project. 4. Collect, evaluate, and display the MIS projects.	HO #10-1: Management Information Systems

MANAGEMENT INFORMATION SYSTEMS

Introduction:

Computer technology is the backbone of a management information system. How MIS is integrated into the curriculum depends greatly on the software chosen for MIS activities. There are four basic types of software packages that can be used to reinforce MIS concepts. These packages are a word processing program, a spread sheet program, a data base program, and/or a business graphics program. The following learning activity ideas are only suggestions. Depending on the time, hardware, and software available, you may want to design your own activities.

Communications:

Communications is one of the important functions of a management information system. The most common tool used for communications is word processing. The following list represents just a few of the word processing packages you may want to consider for a communication activity.

Title	Publisher
Apple Writer II	Apple Computer, Inc.
Apple Works	Apple Computer, Inc.
Bank Street Writer	Broderbund

Once your students have learned how to use a software package, they could use it to address a specific communication problem. One possibility is to use a computer and a word processing package to create a memo addressing an industrial topic. The memo could use the following format:

To: _____

From: _____

Date: _____

Regarding: _____ (the topic chosen)

Content of the memo . . . . . .

. . . . . .

Content for the memo could be on topics like:

1. a safety rule
2. an industrial arts club event
3. a test question a student thinks will be on the test
4. instruction regarding how to use the printer or other piece of equipment
5. what students are learning about computers in industrial arts class (make this one to a school board member, to the administration, or to other teachers)
6. a management function in a student enterprise
7. a piece of school equipment needing service (fixing, oiling, sharpening, cleaning, etc.)
8. a new class policy (clean-up, first aid, reporting broken equipment, make-up work, etc.)

Financial Affairs:

Managing money is often a problem even in a small student enterprise. Industry manages their money with the aid of a spread sheet program. The following list represents just a few of the spread sheet programs you may want to consider for a money management activity.

Title	Publisher
Apple Works	Apple Computer Inc.
VisiCalc	Visicorp
Multiplan	Microsoft

To help students be successful, you may want to set up the program so all students have to do is enter data and print information in its processed form. the data provided could be for a student enterprise. Students would use the program to determine or forecast a profit margin for a student enterprise.

Record Keeping:

Even in a student enterprise, records have to be kept. Organizing and keeping records is often easier with a data base program. Listed below are a few of the data base programs that can be used in the classroom.

Title	Publisher
Apple Works	Apple Computer, Inc.
Bank Street Filer	Broderbund
Quick-File	Apple Computer, Inc.
Visifile	Visicorp

After a short introduction to the program, students could create a data base for the class. Each student could enter, retrieve, and/or print out their own data regarding topics like:

1. attendance records
2. assignments completed and needing to be completed
3. AIASA club membership
4. AIASA club dues
5. students' names, addresses, and phone numbers
6. lab fees
7. clean up assignments
8. schedules
9. assigned textbook
10. assigned safety glasses
11. locker number
12. locker partner
13. lock combinations

In addition, the established data base could also serve as an electronic mail network. Students could use the data base to send messages to you or fellow students. Another option is to create a data base for a student enterprise. This data base could accommodate inventory, marketing, quality control, personnel, sales, and production records.

Business Graphics:

Creating graphs with a computer can be a lot of fun for students. Business graphics is often a feature on professional data base and spread sheet programs. For your purposes, you may want to consider one of the following stand alone programs for business graphics:

Title	Publisher
Easy Graph	Grolier Electronics Publishing, Inc.
Graphics Department	Sensible Software
AlphaChart	Spectral Graphics Software

After learning how to use the program, students could use it for a variety of applications. One possibility would be to have students graph data regarding their student enterprise (expenses, sale, materials used, labor costs, etc.). Another possibility would be to provide students with raw data/statistics regarding a given industrial topic. The students could use the computer to graph the data using various types of graphs (pie, line, or bar). Have the students determine which type of graph illustrates the data best, print the appropriate graph, and turn it in for a grade.

Teacher Guided Discussion:

Discuss how management information was processed, stored and distributed before the use of computer technology. Define MIS as a system that uses computer technology to process, store, and distribute information. List and discuss the basic applications for MIS technology (communications, record keeping, and financial affairs).

Introduce students to the four basic types of software used in management information systems. Discuss how each type of software is used to facilitate one of the MIS applications. Discuss MIS support technologies. Include in your discussion word processing, telecommunication systems, electronic mail, and electronic funds transfer.

Implementing the Learning Activity:

Each student does not need to experience each MIS application. You could expose students to just one of the applications and software packages. Another implementation option is to divide your class into groups. Each group would use one of the software packages to address one of the applications. At the end of the experience, students could report their MIS activities to their peers.

Demonstrate how to use the software and hardware available for MIS. Your demonstration should include things like gathering, processing, storing, and distributing information. Allow students to participate during the demonstration.

If applicable, provide your students with an MIS problem that can be solved with the available software. Have students process the information provided using the appropriate programs. Provide individual instruction as needed. At the end of the period, collect, evaluate and display the MIS projects.

MANAGEMENT INFORMATION SYSTEMS

Running a business requires a lot of information processing. Personnel, inventory, purchasing, billing, and tax records have to be kept, expenses, incomes, and profits have to be figured. Information regarding personnel, production activities and company policy have to be communicated to managers and employees. Before computers, businesses needed rooms of typewriters, adding machines, and filing cabinets to process and store their information. Computers can now do the job of all these tools. Computers make proces-ing information easier and faster.

Processing, storing, and distributing the information needed to manage an enterprise with the help of computer technology is called "Management Information Systems" or MIS. Management information systems are used to perform three major management tasks. The first one is communication. Managers have to be able to accurately communicate with their employees and fellow managers. This often means putting information in writing. Computers are powerful communication tools.

The second major managerial task is record keeping. A business has to keep a lot of records. Many of the records are required by law. Records need to occupy as little space as possible and managers need to have easy access to them. A computer can also be a powerful record keeping tool.

The third area is managing the financial affairs of the company. Managers have to know how much money is coming into the company, how much money the company is spending, and if the company is making a profit. Financial information needs to be as up-to-date as possible. Computers can help managers monitor the financial status of their company.

In order to help manage these areas, four types of software are commonly used. The first one is word processing programs. Word processing programs help management staff prepare written documents with a computer. These documents include things like letters, memos, manuals, and reports. Often these documents need to be written, edited, rewritten, and at a later date, revised. Word processing makes preparing documents faster and easier. Changes can be made in a document without retyping it. Word processing enables the writer to add information, delete information, make corrections, move sentences, move paragraphs, or print the final draft with a few key strokes.

The second type of application software is called data base programs. A data base program reduces the need for filing cabinets. This program enables managers to organize managers to organize and store information. After the information is stored, it can be rearranged or pulled out to meet the needs of management. For example, data bases are often used to keep personnel records. Through a data base you could easily determine all the employees celebrating a birthday during any given month. Information can be stored, accessed and updated faster and easier in an electronic form than it can be on paper. In addition, since the information is stored electronically, it requires less space.

The third type of application software is called spread sheet programs. Spread sheet programs help managers handle financial information. They make the computer a powerful accounting tool. A spread sheet program helps managers organize information, process data, and forecast the future. Through a spread sheet program, managers can determine the financial status of their company easier and faster than the traditional methods.

The last type of software used to help managers process information is called business graphics programs. Business graphics programs are often a part of spread sheets and data base programs. Through a business graphics program, information can be converted into charts or graphs. In a pictorial form, information becomes more interesting and easier to understand. For managers, business graphics is a very valuable communication tool.

In addition to applications software, MIS often takes advantage of other forms of computer technology. One example is called electronic mail. With electronic mail, documents can be sent to a given destination electronically. This is often cheaper, easier, and faster than sending messages on paper through the post office. The electronic mail can be sent to someone within the company or to another company.

Telecommunications technology enables managers to use their computer to communicate with other computers using the telephone. A device called a modem is used to link the computer to the telephone line. Through this link, information can be sent from one computer to another.

The last MIS support technology is called electronic funds transfer (EFT). This allows managers to move money electronically. Using traditional methods of moving money, it can take days to complete a transaction. With EFT, transactions can be made in seconds.

Management information systems help companies save time, minimize waste, be more productive, and make a profit with the aid of computer technology. A profitable company is a healthy company. Choose a healthy company when you select a job.

UNIT: Exploring Computer Technology

LESSON 11: Review and Student Evaluation

Objectives	Lesson Content	Learning Activities	Ref.
A. Following a review on a written objective test, students will be able to complete given concept statements regarding computer technology with a minimum of 70 percent accuracy.	A. Review 1. Intro. to information processing 2. hardware 3. computer languages and software 4. planning computer programs 5. writing computer programs 6. computer-aided design and drafting 7. computer-aided manufacturing 8. robotics 9. electronic publishing 10. management information system	A. Teacher Guided Discussion 1. Review the major concepts explored during the unit. 2. Provide students with an opportunity to ask questions before the test. 3. Provide each student with HO #11-1 and make sure each student has a pen. 4. Explain the directions for the test. 5. Have students read the test and answer the questions provided. 6. Collect tests and grade your students' performance. 7. Provide students with feedback regarding their test performance as soon as possible.	TA #11-1: Review and Evaluation HO #11-1: Test

REVIEW AND EVALUATION

Review:

Review the major concepts addressed during the unit. Include in your review basic information processing, computer hardware, software, program planning, writing programs, CAD, CAM, robotics, electronic publishing, and MIS. Have students participate in the review by asking and/or answering questions.

Administering the Test:

Have students sit in their assigned locations for a test. Provide each student with HO #11-1. Make sure each student has a pen. Explain the directions for the test. After all questions regarding the directions have been answered, have your students begin taking the test. Circulate around the classroom and provide individual help if appropriate. Collect the test at the end of the class period. Evaluate each student's performance on the test. Provide your students with feedback regarding their performance on the test as soon as possible.

SAMPLE TEST QUESTIONS

Directions: Read each question carefully. In the blank provided, write the letter of the answer option which best completes or answers the question.

1. _____ The physical parts of a computer system are called

   A. software
   B. hardware
   C. firmware
   D. memory

2. _____ The only computer language the computer really understands is called

   A. high-level
   B. basic
   C. machine
   D. fortran

3. _____ Which of the following represents an input device?

   A. monitor
   B. printer
   C. plotter
   D. keyboard

4. _____ Information entered into a computer system is first stored in the

   A. random access memory
   B. read only memory
   C. central processing unit
   D. monitor

5. _____ Which of the following is not an example of a high-level computer language?

   A. basic
   B. fortran
   C. logo
   D. machine

6. _____ One binary digit is commonly called a

   A. byte
   B. bit
   C. chip
   D. ram

7. _____ A complete computer on a single integrated circuit is called a

A. microprocessor
B. minicomputer
C. microcomputer
D. calculator

8. _____ A company like General Motors would most likely use a _____ to manage their parts distribution network.

A. microprocessor
B. microcomputer
C. minicomputer
D. mainframe computer

9. _____ The set of instructions given to a computer in order to perform a specific task is called

A. firmware
B. software
C. hardware
D. data

10. _____ The computer language most commonly used with microcomputers is called

A. logo
B. cobol
C. basic
D. fortran

11. _____ In a computer system, the input and output devices are linked to the

A. RAM
B. CPU
C. ROM
D. CRT

12. _____ Which of the means for storage did you use to store your computer program?

A. floppy disk
B. hard disk
C. cassette tape
D. magnetic tape

13. _____ Manufacturing companies use computers to

A. design products
B. control and monitor production machines
C. communicate information within the firm
D. all of the above

14. _____ Which of the following commands can be used to create a pause on the screen when running a program?

A. PRINT:PRINT:PRINT
B. IF/THEN
C. FOR/NEXT
D. GOTO

15. _____ Which of the following commands would you use to put notes in your program without affecting the way it works?

A. PRINT
B. REM
C. INPUT
D. N$

16. _____ Instructions permanently installed in the computer hardware are stored

A. in ROM
B. in RAM
C. on a disk
D. in the microprocessor

17. _____ In order to organize and store information customers (names, addresses, phone numbers, what they have purchased and when), you would need a

A. word processing program
B. spread sheet program
C. data base program
D. graphics program

18. _____ The base material for a computer chip is

A. plastic
B. copper
C. boron
D. silicon

19. _____ An automated factory would feature _____.

A. people drawing plans
B. people operating production machines
C. people using CAD, CAM, and robotics
D. people moving materials

20. _____ Using computer technology to help produce a newspaper is an example of _____?

A. management information systems
B. electronic publishing
C. computer-aided design
D. desk top publishing

21. _____ Which of the following could be programmed to load and unload a production machine?

A. computer-aided manufacturing
B. computer-aided design
C. automated guided vehicle
D. robots

22. _____ Keeping records, managing money, and communications are applications for a _____.

A. management information system
B. electronic publishing
C. computer-aided drafting
D. electronic mail

23. _____ Which of the following parts of an industrial robot is basically a computer?

A. power supply
B. controller
C. end effector
D. manipulator arm

24. _____ If programmed by people, computers can _____.

A. think
B. create
C. feel
D. process information

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